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THE ECONOMIC JOURNAL

MARCH 1960

HOW MUCH SCIENCE? [1]

I

IT is frequently said that Great Britain is suffering from a shortage of scientists and technologists and of the means for conducting research and development and, since the study of shortages is the main interest of the economist, I propose to examine the reasons usually given for making this statement and to speculate a little about how a community can satisfy itself that it is devoting sufficient of its efforts to scientific and technical matters. As I shall try to explain in a moment, the scale of scientific activities in the country is determined by a very puzzling combination of public and private views, public and private action and, in the last resort, the striking of a right balance will inevitably be a matter of judgment and of intuition. Those who take sides too strongly, therefore, are not likely to give good advice, and I fear that, in recent years, some of those who have taken a vigorous part in the campaign for " selling science to the Establishment " have been prone, with the best intentions in the world, to muddle up good arguments with bad and, paradoxically enough, to push the claims of science against the humane studies by making questionable use of history, economics, statistics and even perhaps educational theory.

I begin with some matters mainly of definition. It has become fashionable to speak of " science and technology " in the singular as if what was true of one was inevitably true of the other. But the generalisations that can be made about the two in common are few. In purpose, method and appropriate scale of operation they can best be discussed separately and, although they may frequently have to be discussed as one, that is nearly always evidence of the limitations of our knowledge about them. The practice of bundling the two together has had some very odd results in recent years: for example, when the Russians, by a highly competent piece of engineering, put the first sputnik into orbit, this was used as a proof that more money should be spent on science in Great Britain.

A second truism. If we train in the Universities more people in the sciences or in technology, then there will be fewer of the ablest segment of the community trained in the other disciplines. This would be untrue only

[1] Presidential Address delivered to Section F (Economics) on September 4, 1959, at the York Meeting of the British Association.

if the Universities were at present failing in their task of selection, which I do not believe to be the case. If we decide to have more scientists we must pay the price for it. It is an evasion to suggest that we can have more scientists, more technologists, more historians, more doctors, more economists and so on all at the same time. For the question of quality immediately comes in. The proportions of University graduates who fail even now is high (and incidently it is higher in science and technology than in other subjects). To scrape the bottom of the barrel more vigorously, to set out to produce what is sometimes described as a " scientific proletariat " would further increase the proportion of failures; unless, of course, University standards are lowered. The right terms, therefore, in which to discuss this whole question is whether the community will gain by having more scientists or more technologists trained at the expense of non-scientists. Some eminent scientists have declared themselves in very forthright fashion on this subject.[1] Whether they were right or wrong they were certainly, to my mind, discussing the right question.

The most important matter of definition, however, relates to the meaning of the word " shortage." For the economist, a shortage exists when at the prevailing price the demand is greater than the supply. There is a shortage of scientists when, at existing salaries, Schools, Universities, Government Laboratories, Research Associations and Industrial Firms cannot get as many of these people as they would be prepared to engage. In these circumstances it is to be expected that salaries of scientists would rise because of the competition for them. What would be needed and what would follow sooner or later in anything like a free market would be a boost in supply. I propose hereafter to use the word " shortage " in this sense: it is a condition of the market.

There is, however, a second, much hazier, meaning given to the word in present-day discussion. There is said to be a shortage when those individuals and institutions which actually exercise the demand for scientists —those same schools, Universities, public laboratories, industrial firms mentioned above—are not demanding enough of them, are making mistakes in not rating sufficiently highly the contribution that such workers can make to the profits of individual businesses or to the national welfare, are not sufficiently " science-conscious." In this sense it is not merely the supply

[1] The late Lord Cherwell, speaking in the House of Lords on November 21, 1956:

" Humanistic studies are agreeable, and were very valuable in their day. But they do not really help the country to survive today . . . The fact remains that the people of this country must be fed and clothed . . . the contribution of a man like Whittle was even more helpful to the people of this country than the efforts of any of the Regius Professors of History in our own Universities."

Also Sir Alexander Todd:

" To suggest that more than a modest number of those now studying, say, history or literature in our Universities were being trained to the best advantage was not only nonsense but at the present time, dangerous nonsense " (*The Times*, January 3, 1957).

but also the demand for scientists which is inadequate. For this situation I propose to use the term " unmet need."

As I say, this " unmet need " is a vague and perplexing concept (although I am not prepared to argue that it is entirely without meaning). It implies that those people and institutions responsible for exercising the demand for scientists do not really know their job as well as some other group of people who have no responsibility for action or for risk-taking but claim to be able to draw upon some source of higher wisdom. For instance, if a statesman or an economist declares that industry would gain greatly from the employment of more scientists, how does he know? Why should he know better than the industrialist? If he is confident of his conclusions why should he not go into industry himself and make the large profits which the existing industrialists are neglecting to make? A second reason why " unmet need " is so slippery an idea is that it is bound up with the distinction between private gain and social gain. It is possible to argue that even if the employment of more scientists by one particular firm will not increase the profits of that firm, yet it will increase the national income. But social gains and social costs are the most difficult things to measure even in a rough and ready fashion.

II

Let us try now, as an exercise, to answer the questions: what evidence is there of (*a*) a market shortage, and (*b*) an unmet need for scientists in Great Britain? By scientists I mean (following the classification of the Ministry of Labour) persons trained to University levels in biology, chemistry (other than pharmacy), geology, mathematics, physics and general science.

Let us take market supply and demand first. The number of scientists being turned out by British Universities is on the increase. In 1956–57 the number of degrees and diplomas obtained in pure science was more than twice as great as in 1938–39 and 11% greater than in 1949–50. Between 1955 and 1958 the number of full-time students entering University Institutions for the first time in order to pursue courses in pure science increased by 25%. The output of science graduates is, therefore, certain to move upwards in the next three years. And still further increases are being planned for later years. In the three years 1956–59 the total output of scientists from British Universities was in the neighbourhood of 18,000. This was the supply. What was the demand? Fortunately we have a rough idea of that, because in 1956 the Ministry of Labour undertook an inquiry [1] in order to determine the number of scientists already employed in industry, government and education and the number of additional scientists that, in the view of those who employed scientists, would be required in the following three years. The conclusions reached was that by 1959 the net additional demand for scientists would be about 9,500. Even after making

[1] *Scientific and Engineering Man Power in Great Britain*, Office of the Lord President of the Council and the Ministry of Labour and National Service, 1956.

any reasonable allowance for death, retirement and emigration, it seems fairly certain that in these three years scientists were being produced by the Universities at a rate commensurate with the increase in demand as estimated by those who can be supposed to be in the best position to judge.[1]

Have there in recent years been increases in the salaries of scientists disproportionate to the changes in the salaries in other professions, which might have been expected if there had been a shortage? The evidence is very scrappy. In the PEP Report, *Salaries of Graduates in Industry*, 1957, where a study was made of the salaries paid to a random sample of some 4,000 graduates of 1950, the general conclusion was that there was little difference between the earnings of graduates in arts, science and technology. The Report goes on to point out that the pattern of earnings was " not well calculated to encourage men to read science and technology rather than history or languages or some other non-technical subject." By 1959 the median salary of all corporate members of the Royal Institute of Chemistry had reached about £1,700, a 45% increase in the six years 1953–59.[2] By 1956 the median salary of Fellows of the Institute of Physics reached about £1,950, which represented an increase of 35% in the five years 1951–56.[3] In comparison, the average annual salary in manufacturing industry increased by 55% between 1950 and 1958 and the average annual wage by 72%. We must await more figures before reaching a final conclusion. My impression is that the earnings of scientists are still not outstanding in the professional hierarchy; on the other hand, the rapid rate of increase in very recent years may presage big changes.

Even if there is no market shortage is there nevertheless an unsatisfied social need for more scientists? At least four different reasons are given why the community should have more science and more scientists. First, it is said that, quite independently of what kind of career young people may subsequently wish to follow, they should be taught more science in schools and Universities as a part of a good general education. We ought to try to raise the level of scientific literacy. Secondly, it is suggested that more scientific resources should be made available for the purpose of extending man's knowledge of the nature of the physical universe, even if no material advantage could be expected. " The picture we form in our minds of nature will be the more beautiful for being brightly lit." Thirdly, it is claimed that more science is needed in order to strengthen our national defences. And finally, it is stated that more science is a necessity for improving economic standards.

It immediately becomes obvious that the chance of determining " needs "

[1] A new study along the same lines, *Scientific Engineering Man Power in Great Britain 1959*, Advisory Council on Scientific Policy, Committee on Scientific Manpower, came to hand too late to be examined in this article.

[2] Royal Institute of Chemistry. Remuneration Survey. 1959.

[3] Bulletin of the Institute of Physics, January 1957.

of this kind by methods which would possess a commanding logic or find general acceptance seems to be extremely remote. There are great differences of opinion, even between experts, as to the proper place of science in our general scheme of education. How does a community make up its mind what it wishes to spend on the acquiring of pure scientific knowledge which may or may not have usefulness in the narrow sense? It is customary to suggest that the extent to which science should be subsidised for the purpose of national defence is a matter which can be left to military experts. In fact, that is not the case; military needs have no limit and there must be some point at which, as military expenditure increases, the economy as a whole is so weakened that this expenditure becomes self-defeating. Presumably the decisions under the fourth head can be more exactly determined, or at least they can be left to business-men, each deciding on the merits of his own particular case whether increased expenditure on science seems worth while. But even there it is not easy to discern any very clear pattern of business behaviour.

Difficult as it may be to reach a convincing decision about needs on any one of these four grounds, when they are looked at together the complexities multiply quickly. The different needs may be in conflict. In the short period, if the community wants more teachers of science it must content itself with less scientists for work in industrial laboratories. Or, in the longer period, if the community decides that it attaches value to extended knowledge of the cosmos, it may be necessary to sacrifice material standards of living for that purpose. More radio telescopes mean fewer private television sets.

Must we, then, resign ourselves to the idea that the decisions made can never be rational; that action will always have to be taken on but a fragment of all the evidence needed for logical behaviour; and that, having taken decisions, it will never be possible to know whether they were correct or not? Or, on the contrary, can we be confident that, although there can be no precise determination of how much science there should be ideally, yet at the moment there is certainly too little; that although we do not know how far we should go, we can feel confident that we are moving in the right direction? It always seems to me to be an additional enigma of this subject that, despite all its mysteries, outstanding writers and institutions manage, by somewhat mystical processes, to reach confident conclusions that one line of action is palpably preferable to another.[1]

In the next section of this paper I examine the broad tests which, at

[1] Thus the British Advisory Council on Scientific Policy, 1956–57, p. 4, says in one breath:

> "It is not possible to lay down any proportion of the total national effort on research and development which should *a priori* be devoted to the civil sector"

and in the next:

> "But in our view, the resources devoted to civil research and development have been and still are far too small for a country whose competitive position in world trade is dependent upon the economic development of new products and new processes and where the achievement of a rising standard of living must depend mainly on our success in increasing the productivity of the labour force."

various times and places, have been applied in order to determine whether sufficient emphasis is being placed on science. Before doing that, however, it is worth while pointing out that some well-informed observers have suggested that Great Britain is not suffering from an unmet need for more scientists.[1] That view gains support from comparisons between the United States and Great Britain.

In the Appendix, I compare in detail the annual output and the existing stock of scientists in Great Britain and the United States. The conclusions to be drawn (and this is indicative of the grave difficulties of making these comparisons even in the most favourable circumstances) depend crucially upon the view that is taken of the relative standing of science degrees in the two countries. If the first science degree is taken as equivalent in Britain and the United States, then America possesses, and is annually producing, about twice as many scientists in relation to population as Britain. If, on the other hand, the first science degree in Britain is regarded as equivalent to the second science degree taken in the United States, then the advantage would lie heavily with Great Britain. I suggest that, surrounded with all these doubts, a reasonable compromise conclusion is that the two countries are roughly in the same position.

I repeat that I have in this section been dealing with scientists alone. It would be useful if one could prepare a similar analysis for technologists, which roughly means engineers of all kinds. The existing information is not adequate to support conclusions. For the moment it is intriguing to note that in 1955–56 the median earnings of professional engineers was slightly below £1,200.[2]

III

What tests have been applied to determine whether the resources devoted to science and to technology are adequate? The extensive literature on the subject reveals four ways in which writers have sought to establish their case:

1. International comparisons: thus it is frequently asserted that Great Britain is lagging behind other countries, notably the United States and Russia.

2. Industrial comparisons: if one industry is devoting less effort to

[1] Thus the late Viscount Waverley, speaking in the House of Lords on November 21, 1956:

> "So far as pure science is concerned, statistics appear to show that we are in no way behind Russia, the United States of America or any other country. It is in regard to technology or applied science that we are woefully behind."

And Lord Simon of Wythenshawe in the House of Lords on November 21, 1956:

> "I want to make it as clear as I can that the crux of the position today is not scientists; it is engineers. A Nobel prize winner in physics has recently written: 'The Science departments of our Universities are better and more vigorous than they have ever been in the history of this country . . . What is wrong in this country is that there are far too few engineers to develop our scientists' ideas as fast and as well as is done in some other countries.'"

[2] *Engineer*, October 1959.

science and technology than others, it is presumed that this is evidence of failure on the part of that industry.

3. The establishment of positive correlations between industrial output and the number of scientists and engineers employed in industry. The presumption, then, is that an increase in the number of scientists and engineers will increase industrial production.

4. The measurement of the net return, for specific inventions or for particular industries or countries, of investment on research and development.

International Comparisons

Although there are honourable exceptions, recent international comparisons of the scale of scientific effort must rank among the most reckless of all statistical exercises ever made. (Indeed, they suggest that what we are most short of are competent and responsible statisticians.) The common argument is that Great Britain is falling behind the United States and the United States is falling behind Russia. But why should it be assumed that Russia is doing the right thing and the other two countries the wrong? From the experience of the last quarter of a century it surely cannot be denied that Russia is capable of inflicting upon herself massive misdirections of her resources. Why not in this case?

What is meant by the statement that one country is falling behind another? What is the right basis for comparison? For example, I have already suggested that, if some allowances are made for differences in educational standards, the number of scientists being turned out annually by American Universities per thousand of the total population may not be very much higher than in Great Britain. But these statistics of graduates can be looked at in other ways. For example, in 1956, 25% of those who graduated with the bachelor's degree in Great Britain graduated with science degrees; whilst in the United States only 4% of those who took the first degree took a science degree. The reason for this is a simple one: the annual output of University graduates in the United States in non-scientific subjects, in proportion to the population, far outstrips that in Great Britain. Is Great Britain, then, in a more or less favourable position than the United States?

Or again, it seems to be roughly true that the money expenditure in Great Britain on industrial research and development as a proportion of national income is about as high as in the United States. Does this mean that the British position is satisfactory? Some may argue so. But others may argue that the British proportion is relatively high only because the national income is low, and the national income is low only because insufficient funds in total are devoted to research and development. The suggestion would be that if Great Britain spent more on research and development then its national income would increase at least *pari passu*, and the proportion between expenditure on research and development and the

national income would still remain the same. If there is anything in this line of reasoning, then the present situation in Britain could be regarded as highly unsatisfactory. In any case, is it safe to regard the *costs* of research and development as a proper measure of fruitful results? How much truth is there, for instance, in the statement often heard that research in America is carried out on a much more lavish and perhaps even wasteful scale than in Great Britain?

I will not elaborate on the other statistical snags in these measurements. What is a scientist or an engineer? To what extent is a man who " comes up the hard way " necessarily inferior to a formally trained man? These difficulties are great enough when comparing two countries, such as the Unites States and Britain, which are similar in many respects. But when we bring into the comparisons Russia, where social institutions are so different, where independent observers are not allowed to move freely (and where, of course, a good Marxist, by definition, would not be above the use of statistics for the purpose of misleading the decadent bourgeois), then the foundations for conclusions become even more rickety.

But taking the figures most commonly employed, there are some formidable obstacles in extracting real meaning from them. For example, it is said that Russia and the United States have about the same number of qualified engineers. It is also said that the total industrial output in Russia is, at most, about half that of the United States. It follows arithmetically that industrial output, per qualified engineer, is twice as great in the United States as in Russia. Does this mean that Russia makes a prodigal use of qualified engineers or that its engineers are inefficient? Or is it that there is some inherent weakness in the Russian industrial system which makes it essential to employ many more qualified engineers per unit of output than in other Western countries?

The Correlation between Industrial Output and the Number of Scientists and Technologists

The only attempt known to me to establish a link between the number of scientists and engineers in employment and the growth of the economy and, in this way, to predict the future need for scientists and technologists is that of the Committee on Scientific Manpower.[1] Its argument is worthy of close scrutiny. There are three stages in it which can be set down in the words of the Committee's Report:

> 1. There is a definable relationship between the rate of increase of industrial production on the one hand, and the number of trained scientists and engineers employed by industry on the other.[2]
>
> 2. It is more reasonable to base our projections of the likely need

[1] *Scientific and Engineering Manpower in Great Britain*, Office of the Lord President of the Council and the Ministry of Labour and National Service, 1956.

[2] The evidence given in support of this statement is very sketchy. In the United States, where a run of figures of industrial production and the number of engineers exists from 1890, there is no consistent relationship. Thus in the decade 1930–40 industrial output increased 0·15% for each 1% increase in the number of engineers; in the decade 1940–50 industrial output increased 1·2% for each 1% increase in the number of engineers.

for scientific manpower on the assumption that demand within each industry will, on the average, increase in direct proportion to increases in industrial output than on some even more arbitrarily chosen relationship.

3. It would be appropriate to work on the basis of an average increase of industrial production at the rate of 4% per annum.

If, therefore, the number of scientists and technologists is linked to industrial production in this way and if industrial production is to increase at the rate of 4% per annum, then a basis exists for determining the need for the number of scientists and technologists in the future.

This approach is perplexing for more than one reason. Which is supposed to be cause and which effect in this correlation? Is it being suggested that the number of scientists and technologists is the crucial determining factor in economic growth, so that if we do not have a 4% increase in the number of scientists and technologists we cannot possibly enjoy a 4% increase in industrial production? Actually the annual percentage increase in industrial production between 1955 and 1958 was not 4%; production did not increase at all in this period. But the number of scientists and technologists certainly increased. Does this mean that too many scientists and technologists were produced in the period? If not, what becomes of the assumption that there is a definable relationship? If so, and if the crucial mistake made was in the assumption of a 4% increase in industrial production per annum, what is the point of trying to predict the future annual requirements of scientists and technologists by basing it upon another prediction, that of the probable increase in industrial production, which is no easier to make than a straight prediction out of the blue of the number of scientists and technologists required?

An even more puzzling point is that this Committee, along with other authorities, accepts by implication one assumption for which there appears to be little evidence and which is highly pessimistic in character. The assumption is that, since the number of scientists and technologists moves in step with industrial production, output per head of scientists and technologists will never improve, that whatever economies are made in the future they will not be in that particular type of labour. If this were true it would be a striking fact that scientists and technologists could economise in everything but themselves. I do not see why this assumption is made. And I suggest it is pessimistic because, if we accept the idea of a 4% annual increase in industrial production, a short calculation shows that the number of scientists and engineers in Great Britain will have to increase from about 120,000 in 1955 to 5,171,000 in A.D. 2050. That is a lot of scientists and technologists.

Inter-industry Comparisons

Some authorities [1] seek to establish a case for more extensive industrial research and development by pointing out that some industries spend less

[1] See in particular J. K. Galbraith, *The Affluent Society*, p. 99, and the *British Annual Report of the Advisory Council on Scientific Policy*, 1956–57, p. 5.

than others on research and development and by assuming that all industries would gain by raising themselves to the standards of the highest. Now different industries vary greatly in almost every imaginable sense: in capital investment per head; in the raw materials consumed per unit of output; in the types of labour employed; in the methods of financing new expansion; in the extent to which they buy finished or semi-finished parts from other industries; and so on. Nobody doubts that these variations represent the proper responses of different industries to the different circumstances which face them. Why, then, should it be assumed that it is a golden rule, an inflexible uniformity, that, in proportion to size, every industry should spend the same proportion on research and development or devote the same proportion of its labour force to these ends?

The Measurement of the Net Gain Arising from Research and Development

In much recent writing the practice has been common of quoting the *costs* of research and development as a measure of the returns to them, a practice all the more illegitimate because it is in the case of research and development that costs and returns are most uncertain and most likely to fluctuate from time to time and case to case. There have, however, been one or two recent commendable efforts to strike the balance between costs and returns. Thus Z. Griliches, in the *Journal of Political Economy*, October 1958, "Research Costs and Social Returns: Hybrid Corn and Related Innovations," has carried out a fascinating study of the history of the introduction of hybrid corn in the United States and, after trying to determine, on the one hand, the whole of the costs of the research and development which led to it and, on the other, the net increase in the value of the corn crop as a consequence of this innovation, has reached the conclusion that the social rate of return on the research and development of hybrid corn was not less than 700%. There is a fertile field for other similar studies, but the inherent difficulties of generalising from such cases must always be borne in mind. In any specific case the costs may be so widespread, both in space and time, that it is virtually impossible to identify and total all of them; correspondingly the net advantages of an innovation may spread out in so many directions as to defy measurement. More important, one cannot judge of the general effect of research and development by adding up the successes; there are many more failures than successes.

Nevertheless, as it seems to me, we have here the right kind of question to ask. If nothing had been spent directly on technical progress in the past two decades how much poorer would we be than we actually are? We can, of course, never give a precise answer because it is not possible to isolate from many other forces the specific influence of technical innovation. But orders of magnitude, bearing a rough similarity to the conditions that exist in some Western countries, can be indicated. Let it be assumed that net national output per head is increasing at 2% per annum and that the national ex-

penditure on scientific research and development is of the order of 2% of this output. The causes of the increase in output are various: the use of more capital equipment; improved organisation of existing resources; increased efficiency of labour quite apart from any increase in the use of equipment and, finally, technical innovation. If one-fifth of the annual increase in national output could be attributed to innovation, then the rate of return on the expenditure on research and development would be 20%; if one-tenth of the increase in output could be attributed to this factor, then the return on expenditure would be 10%; if one-twentieth, then the return would be 5%. We cannot make a choice with any great confidence between these different possible answers. But, before we too readily accept the higher, optimistic figures, some sobering facts should be kept in mind.

One is that although there has been an enormous increase in the United States in the sums expended on industrial research and development since 1930, when the modern industrial research laboratories began to make their appearance, there does not seem to be any strong evidence that this has made steeper the general upward trend in output per head.[1] And the second is that if we compare the experiences of the different industrial countries in the period since 1945, or in any part of that period, there does not seem to be any very obvious correlation between the rate of industrial expansion and the resources devoted to scientific and technological effort. In relation to their size, the United States and Great Britain have probably spent most on research and development; but they have not been the leaders in the rate of economic growth. Conversely, Germany and Japan and some other European countries have shown the biggest increases in industrial production per head, although, from any information available, they have not distinguished themselves in scientific and technical expenditures.

IV

My principal conclusion is that we should go on searching for better criteria for determining how much the community should devote to science and to technology. I have no doubt that when everything that can be done has been done in devising objective tests for guiding public policy, much room will still be left for intuition, for judgment, for common sense. I would be the first to admit that the process of shuffling resources about until something like the correct balance is struck is not, in itself, a scientific procedure and certainly not one in which scientists should be allowed the last word.

[1] Thus M. Abramovitz: "It is not clear that there has been any significant trend in the rates of growth of total output and of output per head." ("Resources and Output Trends in the United States since 1870," *National Bureau of Economic Research Occasional Paper No. 52*); and J. W. Kendrick, after suggesting that there was a significant acceleration of productivity advance from the end of the First World War as compared with the prior two decades, goes on "there does not appear to have been either further acceleration, or retardation, in the primary trend rate of increase in total factor productivity since 1919." ("Productivity Trends in Capital and Labor," *National Bureau of Economic Research Occasional Paper No. 53.*)

If, however, there have to be guesses, the more informed they can be the better. To my mind we derive no help from such statements as that "modern science and technology is the greatest force for good or ill in the world today" or that "scientists and technologists have a special responsibility, since it is their genius and their skill which alone can bring the material basis of happiness within the reach of all." These are surely myopic misinterpretations of our world in which religious, political and social (and not scientific) ideas are the great moulding forces.

For those whose task it is to put science and technology on the proper map and in its proper place, the following points are perhaps worth considering:

1. Whilst no one would wish to deny that technology and science (in that order) have contributed much to the raising of standards of living in the last two centuries, there is a disposition in these days to exaggerate the contribution they have made and to underestimate that made by new social organisations and institutions. New ways of collecting capital for investment; new systems of controlling currency and banking; new market organisations for bringing goods and services to the right places at the right times; new conceptions of the virtues of free trading; new legal codes and systems of arbitration enabling trade to be carried on more securely and more speedily; in their totality these social discoveries may have contributed just as much as the technical inventions and scientific discoveries of the period.

2. Much loose talk about "the second industrial revolution" is leading us to overstress the potential material benefits of recent scientific discoveries. Atomic energy, to take the most spectacular case of all, must still rank as a very heavy debit item in this scale. For, as a result of it, fearful peoples everywhere are sacrificing their standards of living for the purpose of creating modern weapons of war or systems of defence against them. As for the peace-time uses of atomic energy, all we have are promises, which in recent months have become increasingly tentative, that, at some unidentified future moment, electricity will thus be generated at a cost as low as the present cost of producing electricity by burning oil or coal under boilers.

3. It is by no means clear that for those countries with urgent short-period economic problems, such as intractable balance-of-payment difficulties or levels of poverty which are politically explosive, more science and technology should have the highest priority. It is usually said that for increasing the British export trade the first need is for more vigorous and better-trained salesmen. It is rarely if ever said that British products are failing to sell abroad because of the lack of qualities which they might have possessed if our science had been more advanced or our technology more progressive. In the other field I doubt whether the first need of the undeveloped parts of the world is for more science and technology; indeed, they cannot utilise fully the existing stock of knowledge. On the contrary, what they need above all are more men of the administrative and managerial type and the pervasive spread of specialised skills of all kinds which Western countries take

for granted.[1] India, in particular, seems to me an area where administrative acumen and not more science is the top priority; certainly in that country in recent years the shortage of economists who understood properly the limitations and pitfalls of central economic planning has exposed the economic system to violent stresses that it could well have done without.

4. When something is in short supply the most useful immediate step that can be taken is to economise to the utmost in the use of it. It is, therefore, of extreme importance that the scientists and technologists we already have should be employed to the best effect. I wonder whether that has been true in the recent past in Great Britain.

5. Striking the right balance as to the number of scientists and technologists calls, as I have said, for both public and for private decisions. Errors, carrying with them serious possible consequences, may arise if both types of decision are not made with an eye on the market. Governments may make provision to encourage more young people to train as scientists, but, in the last analysis, it will be business-men who will have to employ most of them. There are reasons for supposing that, as a result of a shortage, the demand for scientists may snowball in a way which will make likely a surplus in the future. If, for example, there is a sudden increase in the demand for scientists in industry, then, since the total supply cannot increase instantaneously, the first direct consequence would probably be that scientists teaching in schools and Universities would be drawn into industry by the higher salaries offered there. So that just at the time when more science teachers were required to augment the annual supply, fewer would be available. The boom would be intensified. And if efforts are made to meet the shortage quickly, then the annual output of new scientists might easily be raised to the point which was too large to meet normal requirements when the backlog had been satisfied.

Allow me to illustrate what I mean by "keeping an eye on the market." First, it is a good working rule to suppose that a business-man knows his business better than anybody else. It is to be feared that the vigorous propaganda from outside for more science and scientists in industry, especially when firms can set costs against taxation at high rates, has sometimes led to industrial research laboratories being established which have had little purpose or value. Second, if the demand for scientists does increase, it is desirable that the salaries of scientists should be allowed to rise: for this at once tends to damp down demand and to increase supply. In this connection I cannot help but feel that the general policy in British Universities of striving

[1] Lord Heyworth, in his annual speech in April 1959, spoke of these problems of the backward countries:

> "There is no pattern of upbringing, no system of education, to develop the outlook and specialised skills which we must look for in countries like this. We cannot do a very great deal to improve matters because the development of patterns of society and ways of thought is part of a nation's historical development which no single firm could massively influence."

to maintain income equality among the various faculties is short sighted and indeed self-frustrating. *If* the Universities accept the contention that there *is* a shortage of scientists and that there is a case for swinging the balance somewhat in favour of science in the Universities, then it is inconsistent to prevent the salaries of scientists from rising in relation to other University salaries. The principle of equality, of trying to pursue a given policy in defiance of the market, is also self-defeating, for it means that the Universities, for a given salary, will get lower-quality people in the faculties short of teachers than in other faculties. Third, if Government Departments and businesses really consider themselves short of scientists they should be prepared to narrow the margin between scientists' salaries and the higher salaries usually given to administrators (often scientists turned administrators); conversely, if they deem it wise not to narrow this margin, they should accept the logic that it is administrators who are in short supply and not scientists.

6. The recent boosting of science has taken the form of arguments which might easily be fatal in the long run to the autonomy of science. The doctrine has been widely spread that, even where scientific investigation is not directed towards some specified, materially useful end, yet it can be confidently assumed that it will more often than not have such a result. If the public, acting through its Government, succumbs to such appeal and puts down its money for what has been offered as a sound investment, it will not unnaturally look forward to a return. It will expect scientists to devote themselves largely to those investigations most likely to lead to material gains and to accept public guidance and control. In " seeking to sell science to the Establishment " scientists may also sell themselves to the Establishment. In fact, the overwhelming mass of scientific thought and observation in the Western world was never designed to bring, has not brought, and is highly unlikely ever to bring the slightest improvement in material standards of living. This, of course, is not a confession of failure. It is simply one way of asserting that the ultimate purpose of science is not to cater for the lower claims of material progress, where indeed its yield is uncertain, fluctuating and sometimes even negative, but to satisfy the higher needs of knowledge for its own sake, where its returns can hardly ever fail to be positive.

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APPENDIX

1. *The Stock and the Annual Production of Scientists in the United States and Great Britain*

The comparison of the existing numbers and the annual output of scientists in the United States and Great Britain is a hazardous undertaking for many reasons, but for two above all others:

(i) In Great Britain the only figures of existing stock relate to " Qualified " scientists. This includes University graduates together with the corporate

and graduate members of certain professional institutions and the associates of certain educational institutions. But, generally speaking, the level is that of the University graduate. In the various surveys in the United States it appears that a somewhat lower standard than this has been normally adopted. Thus in the U.S. Census of Population, Occupational Tables, it appears that, in the past, a considerable proportion of " Chemists " have not had four years of College (*The Demand and Supply of Scientific Personnel*, D. M. Blank and G. J. Stigler, p. 11). In more recent surveys by the National Science Foundation a Scientist is defined as one " engaged in scientific work . . . at a level which requires a knowledge of . . . physical, natural or mathematical sciences equivalent at least to that acquired through completion of a 4-year professional college course." This clearly would make it possible to include those who were self-educated or had come up " the hard way."

(ii) In both countries there are, of course, statistics of the annual number of graduates in the important science groups. But is the first degree, the B.Sc. in Great Britain and the B.S. in the United States, of the same standard in the two countries? It seems impossible to be dogmatic about this. The level of achievement demanded for the first degree varies more widely between one educational institution and another in the United States than in Great Britain. Some observers have gone so fas as to assert that the B.Sc. in Britain should be compared with the M.Sc. in the United States (*e.g.*, *Universities and Industry*, Productivity Report: Anglo-American Council on Productivity, pp. 11, 12). Without going so far as that, it seems reasonable to suggest that the British first degree is of a higher standard than that in the United States.

2. *Annual Output of Graduates in* 1956

The figures for the two countries are shown in the tables below.

GREAT BRITAIN

First Degrees Awarded in Pure Science Faculties, 1955–56

Honours	
Chemistry	1,027
Physics	624
Mathematics	465
Total Degrees *	4,920

* Including Pass Degrees

Source: University Grants Committee.

UNITED STATES

Earned Degrees Conferred at First and Second Level, 1956

Field	Bachelors' and First Professional Degrees	Second Level Degrees
Chemistry	6,178	1,164
Physics	2,335	742
Mathematical Subjects	4,660	898
Total*	28,898	5,312

* *i.e.*, Biological Sciences, Mathematical Subjects, Physical Sciences.

Source: Statistical Abstract of the United States, 1958.

The conclusions which will be drawn from these tables will depend greatly upon one's judgment of the comparative standards of the first degrees. If the standards were the same then, taking together Chemistry, Physics and Mathematics as the most clear-cut group, the United States, with a population three and a half times greater than that of Great Britain, would show an output of graduates six and a half times greater. If the British bachelor's degree corresponded to the U.S. master's degree, then the United States would show an output of graduates only about one-third greater than the British. If the truth lay somewhere midway between these two assumptions, it would suggest that, after allowing for the different size of population, the output of science graduates was about the same in the two countries.

3. *The Existing Stock of Scientists*

Ideally, it would be desirable to compare in the two countries the total number of scientists employed in all tasks, the number employed in industry and, within the number employed in industry, the number employed in research and development where the scientist is engaged upon the tasks for which he has been scientifically trained. The nearest approach to this ideal is provided in the tables below.

GREAT BRITAIN

Qualified Scientists Employed by All Authorities and in Industry, 1956

Qualified Scientists	All Authorities *	Industry
Chemists	20,692	13,195
Physicists	10,484	4,132
Mathematicians	11,482	1,387
Total	51,228	19,468

* Central Government; Local Authorities; Education and Industry.
Source: Scientific and Engineering Manpower in Great Britain, 1956.

UNITED STATES

Scientists Employed by All Authorities; in Industry and on Research and Development in Industry, 1954

	All Authorities	Industry	Research and Development in Industry
Chemists	—	60,000	26,800
Physicists	—	7,500	4,800
Mathematicians	—	6,400	2,500
Total	290,000 (?)	145,000	52,000

Source: Science and Engineering in American Industry: 1953–54 Survey, National Science Foundation.

Here again we reach the conclusion that with three and a half times the population the United States appears to have six times the number of scientists possessed by Great Britain. That margin would be reduced in proportion as the standard of "scientist" were lower in the United States.

PROGRESS IN BRITISH MANUFACTURING INDUSTRIES IN THE PERIOD 1948–54[1]

A. Introduction

This paper presents the preliminary results of a piece of research, the aim of which is to measure changes in the productivity of manufacturing industry in the United Kingdom, taking account of changes in the amount of both capital and labour used. The selection of the particular period 1948–54, once it had been decided to investigate contemporary conditions, was determined by the availability of statistics. The decision to examine manufacturing industry was taken on the grounds that, in that sector, meaningful measures of changes in output in real terms are available.

An effort is made only to measures changes in efficiency, or " progress." No attempt is made to assess how far the actual level of efficiency falls below some theoretical standard which might be regarded in some way as " best known practice." Such discrepancies probably vary considerably between industries, offering scope for different rates of progress, quite apart from the development of new techniques. Considerations of this nature are obviously of importance in interpreting the measures of progress.

At this stage, manufacturing is divided into the fourteen industrial orders, for each of which the progress is calculated. Not only is there the purely descriptive advantage in measuring progress industry by industry, but also this approach is essential for the purpose of analysis of the causes of progress, though for this latter purpose a finer classification would probably be of greater value. It is hoped at a later time to measure progress for about forty manufacturing industries, and at that stage to analyse the results more completely. The immediate objectives of this exercise are, first, to develop a measure of economic progress which can be applied industry by industry, and secondly, to apply that measure to a small group of industries.

A useful conceptual starting-point is to consider measures of change in labour productivities. In recent years these have had considerable vogue, though they have obvious serious limitations. In working with them one is permanently aware of the problem of the extent to which any labour productivity increases are attributable to changes in the quantity of capital employed, which in this context is regarded as the use by industry of physical resources. Data on changes in capital/output ratios would obviously throw light on the significance of changes in labour productivities, but in the

[1] The authors wish to thank Mr. M. Farrell for useful suggestions and the statisticians of several government departments for their help in providing essential data. They are also much indebted to Miss M. Vidaković, who was employed at the Department of Applied Economics for two years as one of the two research workers engaged on the project.

absence of further information the two factor/output ratios would be difficult to handle.[1] Yet an obvious requirement of any measure of progress is that some allowance must be made for capital as well as for labour.

Of course, this procedure of allowing for more than one factor could theoretically be carried further. Yet land, for example, is thought to be fairly insignificant in manufacturing industry, and entrepreneurship is impossible to measure satisfactorily. In the analysis which follows, the quantity of these inputs is implicitly assumed to move proportionately to the quantity of capital, and changes in the *quality* of entrepreneurship (if any) are one of the factors which are reflected in our measure of progress. This treatment should be borne in mind when the progress figures are examined.

Conceptually, then, the measure of progress presented in this paper is one which shows changes in "output per unit of (all) inputs," instead of relating output only to one input, *e.g.*, labour. It is perhaps of some interest to record, however, that our first ideas were to measure the rate of "real" return to additional capital invested in each of the various industries. This we sought to do by subtracting from the increase in output produced between two years an allowance for extra labour employed, and then relating the residual change to the additional capital employed. This approach of allowing progress in each industry to be reflected in the rate of real return on extra capital employed had many attractions, apart from its apparent avoidance of awkward statistical problems; thus it seemed to correspond with the fact that capital takes the residual share of a firm's output, and also with the idea that progress stems mainly from the introduction of new capital into industry. But the results soon showed what should perhaps have been obvious *a priori*, namely, that an industry's output may increase by amounts which are quite disproportionate to the amount of extra capital introduced, because the increases may have little or no logical connection with it, being due—for example—to improved methods adopted in firms which have introduced no new capital.[2]

For this essentially empirical research little attention has been given to the more theoretical problems which arise in measuring capital. The relevant capital concept in this work has been taken to be the "quantity" of real resources, buildings, plant, machinery, vehicles and stocks employed by an industry. Basically, as will be seen, these assets have been measured on the principle of constant-price replacement cost, net of depreciation.

[1] Account has to be taken of the fact that the relative importance of capital and labour varies between industries.

[2] We found it helpful to quote to one another Adam Smith's classic example of the boy who reduced the amount of labour required to work a "fire engine" by means of a piece of string. Had we adopted the above approach, the calculation would have shown the real return to the capital introduced (the string) as many thousands per cent per annum: in this case it is clearly wrong to attribute the gain either to the capital or to the remaining labour, and such improvements in methods which involve only minor changes in labour or capital may be important.

B. Method

(1) *The Ratio Method*

In deriving a measure of changes in economic efficiency one is concerned with obtaining measures of physical change for each of the variables being considered, which with the aid of economic weights are combined to derive net output [1] per unit of "combined" factors. This method defers to the requirement discussed above that factors are not related to net output in turn, since the initial step in the procedure consists of combining the two factors labour and capital, the combined input then being related to net output. The change in efficiency can then be gauged by tracing these measures of net output per combined factor input over time, and the efficiency change is defined as the ratio of the rates of change of net output and of combined inputs. It can be conveniently set out in an index form:

$$\text{Productivity Index} = \frac{\text{Net Output Index}}{\text{Combined Input Index}} = \frac{\frac{O_2}{O_1}}{\frac{I_2}{I_1}}$$

In fact, our concern is primarily with the additional efficiency, and in consequence,

$$\text{Progress during the period} = \frac{\frac{O_2}{O_1}}{\frac{I_2}{I_1}} - 1$$

For conceptual purposes the most important characteristic of progress in this ratio form is that concern need be directed only at the weights attached to two of the three variables being considered, labour and capital. No relationship between the input prices and the net output price need be specified.

Measuring the combined input index means obtaining the weighted average of the labour and capital indices, a procedure which gives rise to two quite separate weighting problems. The first problem is, irrespective of time, what are the appropriate weights for these factors? The second is, from which point of time during this period are weights to be taken?

(2) *The Weights Used*

The usual method of obtaining a quantity index—valuing the units under consideration at their respective prices in a base period—is adopted, units of labour being valued at a wage rate and capital at a unit return. Thus the labour index is weighted by the base-year wage bill and the capital index by something which for the moment may be thought of as base-year profits (including rent and interest).[2]

[1] As will be seen, output is used net of raw material, services purchased from outside the industry and depreciation.

[2] Its exact nature is discussed below.

The main results presented in this paper are obtained with the use of the customary base year (*i.e.*, 1948) prices. The results of some calculations using 1954 prices are also given and present a picture very similar to that obtained with base year prices.[1]

Symbolically:

	Base Year (1)	End Year (2)
Number of man hours	L_1	L_2
Wage rate	w_1	
Quantity of capital	C_1	C_2
Return to a unit of capital	r_1	
Volume of net output	O_1	O_2
Net output price	P_1	

The combined factor input index is:

$$I = \frac{w_1L_2 + r_1C_2}{w_1L_1 + r_1C_1}$$

$$\text{Progress} = \frac{\frac{p_1O_2}{p_1O_1}}{I} - 1$$

The suitability of the base-year return to capital in each industry to serve as its "price" for weighting purposes requires rather close examination, though a full treatment would take us outside the limits of this article. The return to capital depends on the level of profits and the amount of capital employed. Of these two, profits are a residual return, the level of which fluctuates with changes in the amount of contractual payments and variations in demand and output price. In consequence, particularly owing to short-term price/demand changes, profits are subject to fairly wide variations; in contrast, over a short period the amount of capital employed is fairly constant. Thus short-run increases in demand tend to be reflected in higher utilisation of capital, possibly higher output prices and a high return to capital; temporary falls in demand lead to lower utilisation, lower output prices and a low, perhaps negative, return to capital.

As a consequence, the observed return to capital tends to be a volatile figure, being unstable between industries and over time, and may on occasions take a negative value. There is therefore much reluctance in accepting a pattern of returns to capital observed at any one moment of time as even approximating the likely contribution of capital to output. Even if such a set of returns were available, they might well have to be rejected for our purpose.

[1] The actual calculation of progress using 1954 prices raises a statistical difficulty. In the same way that the relative prices of output, labour and capital assets vary over the period, similarly since the output of any one industry is made up of the production of more than one item, there will be relative variations in the prices of these. Unfortunately 1954 weighted production indicators are not available for this period, and the calculation on the basis of 1954 can be carried out only if the 1948 weighted production indicators, calculated by the C.S.O., are regarded as single quantity relatives for each industry. It is with this assumption that progress on 1954 prices is calculated.

A possible escape from this dilemma is to postulate on an *a priori* basis a capital charge to be applied to all industries. After some thought and taking into consideration the magnitude of earnings gross of tax open to new financial capital, it was decided that a reasonable charge, excluding any depreciation element, and imposed on written-down capital at replacement cost (including stocks and work-in-progress), should not be below 10% or greater than 20% per annum. In fact, for most of the calculations undertaken, a charge of 15% on capital was made [1]; calculations using the estimates of real capital stock which are available indicate that the return in 1948 was of about this size.[2]

Our inclination is to regard the charge of 15% per annum for capital as being if anything on the high side; we sought to err in this direction rather than the other in order not to understate the effect of introducing capital into measures of progress. The effect on the figures of choosing some other rate is, of course, significant, but not as great as one might fear. Thus for All Manufacturing progress in the six-year period 1948–54 comes out as follows:

Assumed charge for capital, % per annum.	Estimate of "progress" in six years, %.
10	16·1
15	13·2
20	10·5

Using this 15% charge for capital ($= r'$), progress is now given by:

$$\text{Progress} = \frac{\dfrac{p_1 O_2}{p_1 O_1}}{\dfrac{w_1 L_2 + r' C_2}{w_1 L_1 + r' C_1}} - 1$$

(3) *The Absolute Change Approach*

Measures of the stock of capital employed by individual industries, even in the fairly straightforward sense in which it is required for our purpose, are still very much in the pioneer stage,[3] and in consequence it was thought

[1] This uniform 15% charge is ultimately levied on new capital being employed by an industry. One can regard it as the social, or opportunity cost to be met by each industry for the use of new capital. It is interesting to consider whether a uniform wage should similarly be charged per man in each industry, instead of adopting the base-year wage as the weighting price. On the whole, it seemed to us that inter-industry variations in wages should be retained as reflecting in some degree differences in skill, but the arguments are nicely balanced. Proportionately the differences are much smaller than those in the return on capital.

[2] For details of this calculation, see Technical Appendix.

[3] F. N. P. Redfern, "Net Investment in Fixed Assets in the United Kingdom 1938–1953," *Journal of the Royal Statistical Society*, Series A, Vol. 118, Part II, 1955, pp. 141–92.

Redfern's data, derived on the perpetual-inventory method, include figures of gross and net capital stock for Manufacturing and Distribution. No figures are given, however, for our individual industries.

T. Barna, "The Replacement Cost of Fixed Assets in British Manufacturing Industry in 1955," *Journal of the Royal Statistical Society*, Series A, Vol. 120, Part I, 1957, pp. 1–47.

Barna's capital data are based on insurance values. Whilst gross capital figures are presented for each industry separately, Barna has no information on net capital stock, and our concern is primarily with this.

inadvisable to have such preliminary figures as a base for one of the three main variables being considered.[1] In contrast, gross capital formation figures are available on a much firmer basis, particularly for the period since 1948. This prompted an attempt to derive a formula which enables the variables to be expressed in the form of an absolute change (thereby dispensing with the need for base-year total figures) and yet provides an approximation to progress as yielded by the ratio approach.

If it is assumed, first, that the actual labour and capital returns exhaust net output in the base year, and secondly, that the actual capital return (r_1) as opposed to 15% (r') is being used, then:

$$w_1L_1 + r_1C_1 = p_1O_1$$

With this, the ratio formula given above simplifies to

$$\text{Productivity Index} = \frac{p_1O_2}{w_1L_2 + r_1C_2}$$

With:

ΔO = Extra output (compared with 1948) produced in 1954
ΔL = Extra labour (compared with 1948) employed in 1954
ΔC = Extra capital (compared with 1948) employed in 1954

Then:

$$w_1L_2 = w_1L_1 + w_1\Delta L$$
$$r_1C_2 = r_1C_1 + r_1\Delta C$$

So that:

$$\text{Productivity Index} = \frac{p_1O_2}{p_1O_1 + w_1\Delta L + r_1\Delta C}$$

In effect, this expression is comparing net output in the end year (p_1O_2) with base-year net output (p_1O_1), together with an allowance for the additional factors employed ($w_1\Delta L + r_1\Delta C$).

Furthermore,

Since $$p_1O_2 = p_1O_1 + p_1\Delta O$$

$$\text{Progress} = \frac{p_1\Delta O - (w_1\Delta L + r_1\Delta C)}{p_1O_1 + w_1\Delta L + r_1\Delta C}$$

The logic of this formula is really quite straightforward. If the quantity of factors used had been the same in the two years we would measure progress simply by dividing the increase in output by the output in the base year. Where, as is usually the case, more factors were used in the later year, we must obviously subtract an allowance for this from the extra output; we must also add an allowance for extra factors to the base-year output

[1] These stock of capital figures are, however, used to estimate figures of somewhat less importance.

before relating the adjusted increase to it, since the extra productivity applied to them too. Thus we may think of " progress " as

$$\frac{\text{Increase in output, } \textit{less} \text{ Allowance for extra factors}}{\text{Output which would have been attained with unchanged productivity}}$$

The principal characteristic of this formulation of progress is that it requires us to introduce a relationship between the output price and the prices of the factors, instead of merely an " internal " relationship between the latter (for weighting purposes).

(4) *The Required Modification to the Absolute Change Formulation*

With the adoption of a uniform 15% (r') as the rate to be applied to capital we have the difficulty that in general the rewards of the factors will not add up to the value of the product: in symbols,

$$w_1L_1 + r'C_1 \neq p_1O_1$$

As a consequence of the reasoning in Section (2) we can regard this discrepancy as arising from the presence on the output side of the equation of the *observed* net output price, rather than the net output price appropriate to the postulated return to capital of 15%. Since the absolute-change formula depends for its exact applicability on the identity of the above equation, in using 15% as the weight for capital the corresponding net output price should be substituted for the observed price. This (p'_1) is given by:

$$w_1L_1 + r'C_1 = p'_1O_1$$

Alternatively:

$$p'_1 = p_1(1 + h)$$

and

$$w_1L_1 + r'C_1 = (1 + h)p_1O_1$$

Progress is now given by:

$$\text{Progress} = \frac{(1 + h)p_1O_2}{w_1L_2 + r'C_2} - 1$$

$$= \frac{p_1\Delta O - (w_1\Delta L + r'\Delta C) + hp_1\Delta O}{p_1O_1 + w_1\Delta L + r'\Delta C + hp_1O_1}$$

At this point it is evident that the problem introduced by the absence of capital stock statistics cannot be completely avoided, since the base-year stock of capital is required to calculate the net output price discrepancy h.

$$h = \frac{w_1L_1 + r'C_1}{p_1O_1} - 1$$

If no data at all on capital stock are available, h cannot be found, and an approximation only to progress is given by the formula:

$$\text{Progress} = \frac{p_1\Delta O - (w_1\Delta L + r'\Delta C)}{p_1O_1 + w_1\Delta L + r'\Delta C}$$

Inspection of the two formulæ suggests that the approximations are likely to be fairly good, even where h is as large as is at all probable, since its introduction moves both numerator and denominator in the same direction. The effect of a given h will be proportionately greatest where an industry has expanded considerably, but progress is small, so that nearly all the increase in output is absorbed by the allowance for additional factors; where there is no allowance to be made for additional factors, no problem arises.

The main sets of results presented here are derived from this formula as approximations to progress. This means that they are derived without any use of the uncertain figures for the stock of capital existing in 1948.

(5) *Estimates of Progress with Adjusted Net Output Price*

It is possible, however, using the figures of capital stock presented by Barna and Redfern to arrive at some estimates of the net stock of capital employed in each industry. The method of obtaining these estimates, which are of very poor reliability, is set out in some detail in the Technical Appendix. Despite their unreliability, it is thought that they can be used to yield for each industry an estimate of h, in effect the appropriate net output price by which the approximate progress results may be adjusted. One should appreciate that, in view of the poor reliability of the capital stock statistics, the consequent estimates of progress with this adjustment are not necessarily superior to the results yielded by the approximate progress calculation. It is probably better to regard differences between the two measures as an indication of the magnitude of error attached to the particular approximate progress figure, which is attributable to the use of the actual net output price rather than that corresponding to a 15% return to capital.

Since the capital charge applied is little different from the estimated return to capital in 1948, the value of h obtained for All Manufacturing is, of course, small, and the resulting adjustment to progress is negligible. Individual industries have fairly high values for h, but, though the disparity between progress and adjusted progress is consequently more marked in particular industries, in no industry is the adjustment very great. Taking all the industries, the average differences (neglecting sign) between the two sets of results is only 0·2% per annum.

C. Time Lags and Statistical Points

Selection of the period 1948–54, for the main calculations, was determined by the availability of the statistics. Sufficiently detailed capital formation figures or production indices were not available prior to 1948, and the year of the latest full census of production, 1954, determined the choice of the end year.

The application of the progress measure to such a short period as six years has some disadvantages, in particular the effect of new capital may not be fully felt. In this research it has been provisionally assumed that on average we can treat capital expenditure in all industries as fully effective from the beginning of the calendar year succeeding that in which it was made, but as having no effect within that year. This assumption must be justified mainly on the grounds of convenience for use with annual figures; broadly speaking, it implies an average time lag of about six months between expenditure and fully effective operation. Over a long period, these effects may be neglected, but applying the progress measure to as short a period as six years, in so far as the above time lag is inadequate, might give unwarranted results in those industries where the rate of capital expenditure was much higher at the end of the period than at the start. Such industries may be charged for capital before the effect of that capital on output is fully felt, giving too low a figure for progress. In the absence of capital-formation figures prior to 1948 it is only possible at this stage to point out the deficiency, which must be remembered when examining the results. Variations in the time lag may be tried in later work.

Though working with a longer period would reduce the importance of this time-lag problem, it would at the same time introduce the peculiar difficulties encountered when measuring production movements over long periods. Even as it is, the figures of the change in real output which have been used are, in relation to their importance, probably the weakest link in the calculations.[1]

The sources of the basic data, and, where required, the methods of estimation employed, are contained in the Technical Appendix. The following points may however be usefully noted here:

(*a*) The variables are all measured at 1948 prices.

(*b*) The output used is output net of the cost of raw materials, the cost of services obtained from outside the industry and an allowance for depreciation.

(*c*) The labour change represents the change in man hours worked and covers salaried employees and workers on own account.

(*d*) Capital is measured less an estimate of depreciation.

D. Method of Presenting Results

The basic data about net output, depreciation, labour and capital formation, on which all our calculations rest, are given in a table in the Technical Appendix. Those figures contain much which is of great interest in other

[1] Apart from all other difficulties, the index of production can only imperfectly reflect changes in the quality of an industry's product.

connections,[1] but the information needed to make estimates of progress has been extracted from them and presented in Table I. The terms used have been described broadly above and fuller particulars are given in the Appendix.

Table I first provides for each industry a figure for the increase between 1948 and 1954 in true net output (*i.e.*, after deducting depreciation as well as all purchases from outside the industry), with all measurements done at 1948 prices; in our notation, this is ΔO. The next two columns give the increase in the wage-bill, measured at 1948 wage-rates ($w\Delta L$) and the "charge" for extra capital introduced ($0{\cdot}15\Delta C$).

By subtracting these two allowances for additional factors one then gets in column (4) the increase in output in the six years due to progress. This is expressed in column (5) as a percentage of what output would have been in the absence of progress (*i.e.*, $O_1 + w\Delta L + 0{\cdot}15\Delta C$), and column (6) converts this into an annual compound rate of progress. In a sense this column contains the main result of our labours.

Columns (7)–(9) are all in a sense checks on the reliability and usefulness of the figures for progress given in column (6). Thus column (7) gives figures which have been adjusted for the discrepancy between the actual net output price and the one which would correspond to a return of 15% on capital: as indicated above, the adjustments are mostly rather small, and negligible for manufacturing as a whole. Column (8) shows the results obtained by using 1954 prices instead of 1948 prices, and here too the differences are rather surprisingly small. Column (9) shows the effect of averaging two years both at the beginning and the end—a precaution which we took initially to reduce the influence of possible abnormalities in a particular year; as the period is thereby changed, slightly, one cannot expect to get identical results, but the change for all manufacturing is only from 2·1% to 1·9%, and over the fourteen industries the average difference (neglecting sign) is only 0·3%.

Columns (10) and (11) of Table I give figures for progress for two subperiods, 1948–51 and 1951–54. The significance of these is considered in the next section.

Table II gives for each industry index numbers of output, labour and capital in 1954, taking 1948 as 100. From these, index numbers of labour productivity, capital productivity and capital per man-hour are deduced.

[1] A few examples may serve as an indication of the subjects on which they throw light. Thus for manufacturing as a whole in the six years 1948–54 we find that:

(*a*) Depreciation (reckoned at replacement cost) was equal to nearly half the value of gross fixed capital formation, and so almost equal to net fixed capital formation.

(*b*) Investment in additions to stocks and work-in-progress (which to our shame we started by ignoring) represented 40% of total net capital formation—in engineering the proportion was as high as 60%.

(*c*) Depreciation, even at replacement cost, was rather less than 5% of net output, both at the beginning and the end of the period.

TABLE I

Progress

(£ million at 1948 prices or percentages)

S.I.C. Orders	Changes (1948–54).			Progress (1948–54).			Supplementary progress calculations (annual compound rates).				
	In net output less depreciation, $\triangle O$.	In wage bill at 1948 wage-rates, $w\triangle L$.	15% of change in net fixed capital and stocks, $r'\triangle C$.	Extra output "due to" progress, $\triangle O - w\triangle L - r'\triangle C$.	Percentage progress over the period.	Progress annual compound rate.	Adjusted progress,* 1948–54.	Progress at 1954† prices.	Progress, 1948/49–54/55.	Progress, 1948–51.	Progress, 1951–54.
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
	£m.	£m.	£m.	£m.	%	%	%	%	%	%	%
III. Bricks, Glass, etc.	30·7	8·2	13·5	9·1	5·7	0·9	0·7	0·9	0·8	1·5	0·5
IV. Chemicals	144·3	23·1	56·4	64·8	22·2	3·4	3·7	3·8	3·1	4·6	2·8
V. Metals	61·1	4·9	39·2	17·0	5·3	0·9	1·0	1·0	1·0	1·0	0·7
VI. Engineering	310·7	96·1	63·9	150·6	16·3	2·5	2·7	2·6	2·6	5·4	0·3
VII. Vehicles	210·3	84·5	37·9	87·9	17·7	2·8	3·5	2·9	2·6	4·3	1·9
VIII. Metal Goods N.E.S.	21·6	3·8	11·0	6·7	3·0	0·5	0·3	0·5	0·9	2·8	−1·7
IX. Precision Instruments, etc.	11·3	4·6	3·0	3·7	6·7	1·1	1·4	1·4	0·5	0·3	1·9
X. Textiles	61·5	17·0	13·9	30·6	7·5	1·2	1·3	1·1	0·6	3·0	−0·6
XI. Leather	−1·8	−1·3	0·9	−1·4	−3·8	−0·7	−0·6	−0·7	−0·9	−1·1	−0·2
XII. Clothing	28·4	6·2	3·7	18·5	8·7	1·4	1·4	1·2	1·2	1·2	1·5
XIII. Food, Drink and Tobacco.	76·4	24·6	42·7	9·1	1·7	0·3	0·2	0·0	−0·1	−1·3	1·9
XIV. Wood and Cork	55·1	3·2	6·6	45·3	34·4	5·0	5·0	4·9	4·5	6·3	3·9
XV. Paper and Printing	126·8	32·3	12·5	81·9	30·9	4·6	4·7	4·8	4·3	7·9	1·8
XVI. Other Manufacturing	44·0	7·7	6·6	29·7	23·7	3·6	3·4	3·3	4·0	4·5	3·0
III–XVI. All Manufacturing	1,180·3	314·8	311·9	553·6	13·2	2·1	2·1	2·0	1·9	3·3	1·1

* Adjusted to allow for the discrepancy net output price (see text, p. 26).

† See text p. 20, footnote.

TABLE II

Changes in Real Terms

(Index numbers for 1954 with 1948 = 100)

S.I.C. Orders.	Net output (1)	Labour. (2)	Net fixed capital and stocks. (3)	Labour productivity. (4)	Capital productivity. (5)	Capital/labour ratio. (6)
III. Bricks, Glass, etc.	122·3	108·4	151·1	112·9	80·9	139·4
IV. Chemicals	167·7	117·9	155·7	142·2	107·7	132·0
V. Metals	122·0	102·4	141·7	119·2	86·1	138·4
VI. Engineering	140·8	116·7	129·1	120·7	109·0	110·7
VII. Vehicles	156·2	126·4	128·8	123·6	121·3	101·9
VIII. Metal Goods, N.E.S.	110·2	102·6	128·9	107·4	85·5	125·6
IX. Precision Instruments, etc.	123·3	111·0	120·8	111·1	102·1	108·8
X. Textiles	116·2	106·9	108·1	108·8	107·5	101·1
XI. Leather	95·1	94·5	112·9	100·6	84·3	119·4
XII. Clothing	114·0	103·8	111·1	109·8	102·6	107·0
XIII. Food, Drink and Tobacco	116·6	110·5	129·2	105·5	90·2	116·9
XIV. Wood and Cork	145·3	103·4	132·9	140·5	109·3	128·6
XV. Paper and Printing	157·5	121·1	116·1	130·1	135·7	95·8
XVI. Other Manufacturing	139·7	110·6	123·0	126·3	113·6	111·2
III–XVI. All Manufacturing	133·2	112·6	128·0	118·3	104·0	113·8

E. REVIEW OF THE RESULTS

In inspecting the results, as with the methodology, examination of labour productivity provides a useful starting-point. Table II shows an increase of 18% for All Manufacturing over the six-year period. Though labour productivity has fallen in none of the fourteen industries, the range of experience is wide: thus the industry having the largest increase is Chemicals, where labour productivity increases by 42%, whilst at the other end of the scale Leather barely shows any increase. In all, three industries—Chemicals, Wood and Cork, and Paper and Printing—have a labour productivity increase of more than 30%, whilst in five industries—Leather, Food, Drink and Tobacco, Metal Goods N.E.S., Textiles and Clothing—labour productivity increases by less than 10% over the period.

In almost every Order—the exception is Paper and Printing—capital employed has increased by a greater percentage than labour, a fact readily seen from the indices of capital per man-hour. Therefore with our definition, " progress " is bound to appear as lower than the recorded increase in labour productivity.[1] An alternative way of expressing this fact is to say that part of the recorded increase in labour productivity is attributable to the increase in capital intensity, and in moving from the former measure to progress we have made an allowance for the latter.

[1] In the exceptional industry, Paper and Printing, though capital intensity fell by about 4% over the period, progress is in fact only fractionally greater than the labour-productivity increase. In view of this, the generalisation that progress in all Orders is not greater than labour productivity is reasonable.

One of the objectives which inspired this research was to get an indication of the quantitative importance of this allowance. By the time that one had allowed for the extra capital per man, would the rise in productivity (*i.e.*, output per head) disappear, or be barely changed? The answer seems to be that the effect is of some importance, but not overwhelming: thus after allowing for the extra capital input, the productivity increase for All Manufacturing falls from 18·3 to 13·2%.[1] Similarly, in nine out of the fourteen industries—Engineering, Metal Goods N.E.S., Precision Instruments, etc., Textiles, Leather, Clothing, Food, Drink and Tobacco, Paper and Printing and Other Manufacturing—the allowance made for extra capital reduces the percentage gain in productivity by less than 5 over the period. In Chemicals and Metals, on the other hand, the consequent reduction in productivity is as high as 20% and 14% respectively.

A further point is of interest in connection with the above. Despite the fact that introducing a charge for capital reduces the labour productivity figures by these varying amounts, nevertheless labour productivity is quite a good indicator of relative degrees of progress; in our results the rank correlation between these two is as high as +0·91. When due consideration is given to the importance of labour in production, this particular conclusion may hold little surprise, but it is useful to have some information of the actual extent to which patterns of progress and labour-productivity changes diverge.

Interesting conclusions also emerge from the capital-productivity figures (Table II, column (5)). The fact that the figure for All Manufacturing shows little change over the six-year period may seem reassuring to those who tend to assume constancy in the capital–output ratio (the reciprocal of capital productivity); in economic terms this constancy implies that "progress" at about 2% per annum was sufficient to prevent a fall in the average output per unit of capital, despite the fact that each unit of capital had the co-operation of less labour.

The figures for individual industries show clearly, however, that this constancy observed above for All Manufacturing depends heavily on the word "average," and is in no sense a technical necessity: only half the industries show a change in capital productivity in the six years of less than 10%, and the figures range from a fall of 20% in the case of Bricks, Glass, etc., to a rise of 36% in Paper and Printing. There are only five industries, however, in which progress was insufficient to prevent output per unit of capital from falling, despite the reduced number of co-operating workers.

If we turn to the figures for progress itself (Table I, column (6)), the first

[1] This and many of the other conclusions presented here are paralleled by findings for the U.S.A. over a much longer period. See J. W. Kendrick, *Productivity Trends; Capital and Labour*, National Bureau of Economic Research, Occasional Paper 53, 1956. S. Fabricant, *Basic Facts on Productivity Change*, National Bureau of Economic Research, Occasional Paper 63, 1958.

impression may well be that a figure of 2% per annum for All Manufacturing is too good to be true—remembering that this is after subtracting from the increase in output over the period an allowance for the increase in man-hours worked and for extra capital introduced (at 15% per annum, net of depreciation). This impression is indeed borne out by the analysis into two sub-periods (1948–51 and 1951–54) given in columns (10) and (11): the first, in which recovery from war-time disorganisation was still raising productivity significantly, shows "progress" at 3·3% per annum; the second, and this is probably a better guide to what can be expected as a long-term trend, shows only 1·1%.

Experience between industries in rates of progress has been very varied. Progress during 1948–54 ranges from 5·0% per annum in Wood and Cork down to −0·7% in Leather. Within this range, two rather clearly distinguished groups are displayed. Out of the fourteen industries six have progress of more than 2½% per annum; these are in descending order Wood and Cork, Paper and Printing, Other Manufacturing, Chemicals, Vehicles and Engineering. The remaining industries have less than 1½% progress, and of these, seven are bunched within the relatively narrow limits 0·3–1·4%.

In fact, however, this industry pattern appears to be consistent only in a broad sense over the whole six years.[1] As an extreme example of the shifts which take place between the two sub-periods, Food, Drink and Tobacco, which has the lowest recorded progress in the first period, is ranked 5th in the second, and Engineering ranked 2nd in the first period is only 12th in the second. In the period 1948–51 there is a fairly large gap, from 4·3 to 3·0%, between the high- and the low-progress industries, and it is the above six industries which constitute the former group. In the period 1951–54 there is no such convenient demarcation between high- and low-progress industries, though the only disturbance to the "top six" is the replacement of Engineering by Food, Drink and Tobacco.

Possibly of greater significance than the extent to which the pattern of progress persists through the period is the fact that there was a much greater range of results found in the period 1948–51. In this period the results varied from about 8% per annum in Paper and Printing, down to −1·3% in Food, Drink and Tobacco, whilst in the period 1951–54 all fourteen industries have progress figures between 3·7 and −1·7%.

The reduced dispersion is probably due to the fact that the transition from war-time to peace-time conditions provided more scope for abnormal increases in some industries than others. For instance, industries such as Paper and Printing, which had been restrained during and immediately after the War, could redevelop rapidly as their raw materials were freed from control.

[1] The rank correlation between the pattern of progress in the period 1948–51 and that in 1951–54 is only +0·39.

In addition to noting that such peculiarities at the beginning of the period under review probably played an important causal role in determining the varying industry rates of progress, the only other causal factor which emerges on a cursory examination of the fourteen industries is the association between high (or low) output changes and high (or low) progress. Such an association is not unexpected,[1] but, on the other hand, it is not easy to interpret clearly. One can, of course, generalise and say that progress appears to be associated with " expansion "—provided that this term is restricted to mean increased output and not the employment of more factors, since any association of progress with capital or labour increases is much less evident. What is not yet clear from the results is whether the high output increase causes the high progress or, indeed, whether it is the latter which induces the former. It is possible to provide reasons for both sequences. Output expansion will facilitate the employment of latest techniques and more reorganisation of industry. Progress, stemming from, for example, the application of some new invention, can, by lowering costs and thereby prices, lead to a higher level of production.[2]

This observed association between output changes and progress is very significant in another light. In only one industry, leather, is progress over this period negative.[3] This is the only industry in which output falls, and one is tempted to conclude that a " contraction " is likely to be accompanied by a fall in efficiency in some " real " sense [4]. Whilst such a conclusion could not be justified on the basis of this one industry, in fact preliminary results for Manufacturing Industry much more finely divided—where several cases of negative progress are recorded—tend to support this finding.

A more complete appraisal of causal possibilities is, however, best left until progress is analysed for Manufacturing Industry subdivided by more than the fourteen S.I.C. Orders.

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[1] This sort of association is a well-known economic phenomenon. See, for example, Kendrick, *op. cit.*; Fabricant, *op. cit.*

[2] These matters are analysed at some length, with the aid of other statistical data, in a forthcoming monograph in the Department's series: *Productivity and Technical Change*, by W. E. G. Salter.

[3] An examination of the results for the sub-periods shows that negative progress is recorded in five instances, in Leather and in Food, Drink and Tobacco in 1948–51 and in Metal Goods N.E.S., Textiles and Leather in 1951–54. The only four instances in which net output fell are included in this group—a fact which lends support to the observation which follows.

[4] There is the possibility that the recorded negative progress might be attributable to purely statistical factors, for example, inaccuracies in the data. Analysis of Manufacturing Industry with a finer classification suggests, however, that in most instances this is not the case, but rather that the recorded fall in economic efficiency is a real one—at least so long as one sets the change for additional capital as high as 15% per annum.

Technical Appendix

Measurement of Output

The change in output was measured by the difference in value added, at constant 1948 prices, between the base and the final year. The output figures are required net of all raw materials used, of depreciation, of equipment and of the value of services provided by other industries. In fact, the 1948 net output figure actually used for all Manufacturing is that given in the National Income Blue Book,[1] and from this total, net output figures are derived for each industry on the basis of the weights given to them in the Index of Production.[2] (The divergence between the sum of those weights, which are derived from the Census of Production, and the Blue Book figure computed from factor incomes is small, and may be attributed to some double counting in the former.) Value added for later years at 1948 prices was computed by multiplying each base-year net output by the production index for that Order. From these net output figures by industries the deduction of an estimate of depreciation is made.

Wage and Salary Bills

Method

Wage and salary bills for each year at 1948 wages were obtained by multiplying the 1948 wage and salary bills by indices of change in man-hours worked. The calculations were made separately for males and females, and also for constituent trades within the S.I.C. Orders to allow for more detailed analysis later.

1948 *Wage and Salary Bills*

These were derived from the 1948 Census of Production, adjusted to cover small firms, Northern Ireland and some omitted trades; they correspond to the figures in Table 14 of the 1957 Blue Book. Two further adjustments were made to render the figures more representative of labour costs to the industry. Employers' contributions to National Insurance, pension schemes, etc., were allowed for by adding a uniform 4%, equal to the proportion found in the Blue Book for all manufacturing. The salary element in the remuneration of working proprietors was allowed for by adding a variable amount based on figures in the Inland Revenue Reports. This added another 4% to the total Manufacturing wage and salary bill, the highest percentage (14%) being in clothing. To divide base-year wage and salary bills between males and females, numbers of workers of each sex were weighted by the average weekly earning for October 1948 given in the *Ministry of Labour Gazette*, and the wage and salary bills were split accordingly.

Man-hours

Census figures for average employment in the year, covering working proprietors, were used wherever possible, with any necessary adjustments for coverage of small firms and Northern Ireland.

Hours worked were taken from the Ministry of Labour six-monthly survey. For males, average hours worked by adult males were used, and for females those worked by women. Testing showed that elaborating the method to take account of juveniles would have a negligible effect. For years after 1948, hours worked

[1] At all possible points the statistics used have been keyed to the relevant, 1957 Blue Book figures.

[2] All references to the index of production relate to the one with 1948 as a base.

in April and October were averaged. For 1948 this was impossible because the Standard Industrial Classification was introduced between the two surveys. The October figures were therefore used, and further examination of the figures suggests that no perceptible error is introduced by neglecting April.

Gross Capital Formation

The Blue Book was used as the basic source. Investment in the three main assets, buildings, plant and vehicles, was treated separately in order to deflate each one by the specific price index provided by the C.S.O. Capital formation under the heading Government Research and Development was left out of consideration because the corresponding assets are not employed in the current production of manufactures. Other government-financed capital expenditure in Manufacturing is included.

Depreciation

The starting-point for our estimates is the series of figures for depreciation prepared by the C.S.O. for (*a*) buildings, (*b*) plant and (*c*) vehicles in the field of "Manufacturing and Distribution, etc." The figures were first split between "Manufacturing" and "Distribution, etc." and the total for "Manufacturing" then split between the fourteen Orders. The method used is to split the figures according to estimates, for individual industries, of gross capital stock. The preparation of these capital estimates, which are based on Redfern's capital-stock figures,[1] the source of the C.S.O. depreciation estimates, must first be described.

Allocation of "Redfern" Capital Stock between "Manufacturing" and "Distribution, etc."

Redfern gives figures of gross capital in 1948 for the whole of Manufacturing and Distribution,[2] for industrial buildings, commercial buildings, plant and vehicles. After considering the distribution of capital formation in each of these assets between the two sectors, together with the Inland Revenue depreciation allowances for "Manufacturing" and "Distribution," we decided to assume that Manufacturing had three-quarters of the plant, one-quarter of the vehicles and less than one-half of the buildings.

Allocation of "Redfern" Capital Stock in 1948 between Orders

To carry out the allocation we had recourse to a paper in which Barna [3] presented estimates derived from insurance values of the stock of capital by individual Orders, for the year 1955. These figures, given separately for plant and buildings,[4] relate to gross capital at replacement cost and are therefore similar in concept to Redfern's. They were adapted to give an estimate for 1948 at 1948 prices by first deflating them to 1948 prices, and then subtracting the gross capital

[1] *Op. cit.*

[2] "Distribution, etc." comprises mining other than coal, building and contracting, broadcasting and other services, as well as wholesale and retail distribution and road goods transport. Agricultural vehicles are also included.

[3] *Op. cit.*

[4] The following method was applied separately to: (*a*) plant, and (*b*) buildings. Barna did not give any figures for vehicles, and the method of allocating Redfern's figures for these between Orders is set out above.

formation for 1948–54 (less an estimate of scrappings). The total of the resultant figures exceeds the Redfern total, probably on account of the assumption by Redfern of shorter than actual asset lives, but this Redfern total was allocated between the Orders in proportion to the former.[1]

From the gross capital stock obtained in this manner for each industry at the beginning of 1948, capital-stock figures were calculated for each year to 1954 by the addition of gross capital formation and the deduction of an estimate for scrappings.

The Estimates of Depreciation

With the aid of all these figures for gross capital stock we are now in a position to split the depreciation figures, mentioned at the start of this section, in each year, for plant and buildings. The allocation was done on the basis of the proportion of gross capital stock in each industry at the beginning of the year.[2] Depreciation of vehicles was allocated between Orders on the basis of capital formation in the period.

Stocks and Work-in-Progress

The figures of the physical changes in stocks are derived as the difference between the estimated values, at 1948 prices, of stocks held at the beginning and at the end of the period. Raw materials and fuel are (throughout) treated separately from work-in-progress and finished products.

Stocks at the end of each year at current prices can be obtained from the Blue Book (Table 58, Blue Book 1957) for the following groups of industries:

Chemicals: Covering Order IV.
Metals: Covering Orders V, VI, VII, VIII, IX.
Textiles: Covering Orders X, XI, XII.
Food: Covering Order XIII.
Other: Covering Orders III, XIV, XV, XVI.

With the help of C.S.O., some provisional estimates were made of the value of the physical changes in stocks, at current and mid-1948 prices, for these groups. To obtain stocks at constant 1948 prices at the beginning of 1948 and the beginning of 1951, we use:

(*a*) stocks at the beginning of 1948 from the Blue Book;
(*b*) the addition to physical stocks;
(*c*) has to be converted to mid-1948 prices by an estimate of the price change over the first half of 1948; this is made from the price change implied in the stock changes at current and at constant prices, and the Board of Trade Index of Wholesale Prices.

The stocks at the beginning of 1951 are the sum of (*a*) and (*b*). The real changes in 1951, 1952 and 1953 are added to give the stocks at the beginning of 1954.

[1] We also experimented with other methods of allocation which seemed more logical, but various tests suggested that the above simple procedure was as satisfactory as any.

[2] A test calculation was made using an extreme assumption to see how far the final progress figure would be thrown out by any errors in allocating depreciation. Depreciation was allocated in proportion to gross capital formation since 1948, and progress computed with this. This was compared with progress computed by using depreciation allocated by Barna's stock amended by gross capital formation in the period 1948–54. Only one or two industries showed substantial difference, while the ranking of industries was practically unchanged.

The stocks at these three dates were allocated between Orders by Census of Production current value data. These were converted to mid-1948 prices by implied price indices from the values at current and at constant prices of the physical stock changes in the major groups. It has to be assumed that price changes within the major industry groups are uniform.

Capital and the Net Output—Price Discrepancy

The depreciation figures used are basically those provided by Redfern, and the appropriate capital figure to which the apportioning calculations should be keyed is consequently Redfern's. However, in estimating the net output-price discrepancy, the capital figure required is preferably one which estimates capital directly. (Given the capital figure for each industry the method of deriving h is set out in the text.) Similarly a direct measurement of capital is more appropriate for deriving changes in capital productivity. It was therefore decided to use the Barna capital estimates for these purposes.

The calculation of "Barna" gross capital figures for 1948 has been described above. The major problem was then to derive from these Barna figures, estimates of *net* capital stock. The problem was approached, first, by deriving an estimate of net stock for All Manufacturing, and secondly, apportioning this total between the constituent Orders.

The Barna Net Stock of Capital for Manufacturing

To obtain this, the only available indicator is the relationship which Redfern obtained, for Manufacturing and Distribution, between net and gross capital for 1948. The temptation to apply this relationship [1] as it stands, to derive a net figure from Barna's gross capital, was avoided, since it is considered that the main reason for the difference between Redfern and Barna's capital figures is the underestimated asset lives of the former, and the use of asset lives other than Redfern's would yield a different net capital to gross capital relationship.

It was therefore decided to construct a simplified set of capital formation figures, but one which approximates that found by Redfern,[2] and apply to this series, first, the asset lives used by Redfern, and secondly, some rather longer lives.[3] The proportion of net to gross capital was then calculated for both sets of lives for both asserts. The results are:

Net Capital / Gross Capital.	Plant and machinery.	Buildings.
(*a*) Redfern Lives	0·503	0·568
(*b*) Longer Lives	0·553	0·631
$\frac{(a)}{(b)}$	0·909	0·899

It was ultimately decided to assume, as an approximation, that for both assets the proportion of net to gross capital on a Redfern basis would be 0·9 of the

[1] Redfern finds that for both plant and machinery and industrial buildings, net capital is just greater than half gross capital in 1948.

[2] In particular, the low capital formation of the 1930s slump years and of the war period were taken into consideration. These features are important, since irregular growth of capital stock has a strong influence on the proportion of written-down capital to gross capital.

[3] Redfern assumes a life of fifty years for industrial buildings and an implied average life of about thirty years for plant and machinery. The longer lives assumed here were, respectively, seventy-five and forty-five years.

equivalent Barna proportion. For both assets a Barna net stock figure for manufacturing was obtained from the gross figure together with the Redfern proportion of net to gross capital, and in conjunction with the above factor.

For vehicles, which constitute only a small percentage of capital, Redfern's net capital figure was used, and to these three assets, the figure for stocks and work in progress [1] was added.

The Barna Net Stock of Capital by Orders

The method adopted for deriving individual capital figures involved making provisional estimates for each industry and asset,[2] of the proportion of net to gross capital in 1948, and applying these to the gross capital figures for that industry. The net stock figures obtained in this way were then used to apportion the figure obtained for All Manufacturing in the previous section.

To obtain by industry and asset these provisional proportions of net to gross capital it was assumed that over the half-century prior to 1948 the annual rate of capital growth is approximated by the average annual output change of this period.[3] It was further assumed that this change took place at a constant annual rate within the period. Using this estimate of the rate of capital growth, together with the assumed (longer) lives of assets, one derives algebraically the proportion of net to gross capital for each industry.

The vehicles net capital figure is distributed between Orders according to post-war capital formation and the figure for stocks and work in progress is available by Orders from the above section.

The Return to Capital

The net stock of capital, comprising plant and machinery, buildings, vehicles and stocks and work-in-progress for 1948, is also employed, together with true net output less the wage and salary bill, to yield an estimate of the return to capital in manufacturing industry.

	£ million.
True Net Output	= 3,558
Wages and Salaries	= 2,504
Net Capital	= 7,414
The Return to Capital	= 14·2%

The Net Capital Stock Indices

Table II contains, by Orders, indices of net capital. These were obtained by adding to the 1948 net capital figures the figures for net fixed capital formation and increase in stocks during the period 1948–53 (inclusive). As with all the statistics involving the use of the estimates of capital stock, they are of poor reliability.

[1] See section "Stocks and Work-in-Progress."

[2] The method outlined here was applied to buildings and plant machinery separately. For vehicles, and stocks and work-in-progress, see below.

[3] These were obtained from:

K. S. Lomax, "New Index Numbers of Industrial Production 1900–1938," *London and Cambridge Economic Bulletin*, New Series No. 26, June 1958, pp. v–vi.

B. C. Brown, "Industrial Production in 1935 and 1948," *London and Cambridge Economic Bulletin*, New Series No. 12, December 1954, pp. v–vii.

Basic Data
(£m. at 1948 prices)

S.I.C. Orders	Output.				Labour.		Capital formation.			
	Net output (including depreciation).		Depreciation (at replacement cost).		Wage bill at 1948 wages.		Gross fixed capital formation, 1948–53.	Depreciation (at replacement cost), 1948–53.	Changes in Stocks and Work-in-progress, 1948–53.	Net fixed capital formation and stock change, 1948–53.
	1948.	1954.	1948.	1954.	1948.	1954.				
III. Bricks, Glass, etc.	142·1	176·0	4·6	7·7	97·5	105·6	103·5	35·6	21·9	89·8
IV. Chemicals	231·8	387·8	18·8	30·5	128·8	151·9	455·2	136·9	57·5	375·8
V. Metals	294·8	362·6	17·7	24·4	205·5	210·4	299·7	122·3	83·9	261·3
VI. Engineering	793·7	1,112·1	31·8	39·5	576·9	673·0	379·0	206·7	253·8	426·1
VII. Vehicles	391·1	607·4	16·8	22·7	320·2	404·7	255·4	111·0	108·2	252·6
VIII. Metal Goods N.E.S.	217·5	241·7	6·0	8·6	145·0	148·8	96·5	42·5	19·5	73·5
IX. Precision Instruments, etc.	50·6	62·5	2·1	2·6	41·6	46·1	25·5	14·2	8·6	19·9
X. Textiles	411·2	476·3	32·2	35·8	247·1	264·1	255·9	203·5	40·5	92·9
XI. Leather	38·2	36·7	0·7	1·1	24·1	22·7	12·3	5·2	−1·0	6·1
XII. Clothing	208·0	237·5	4·8	5·9	161·4	167·6	45·8	32·2	11·3	25·0
XIII. Food, Drink and Tobacco.	482·7	568·0	21·4	30·3	235·2	259·9	312·4	150·1	122·4	284·6
XIV. Wood and Cork	125·0	181·6	3·3	4·7	95·0	98·2	44·0	23·3	23·5	44·2
XV. Paper and Printing	234·7	364·0	14·4	16·0	152·8	185·1	140·6	93·0	36·0	83·5
XVI. Other Manufacturing	115·4	160·8	4·4	5·7	72·8	80·5	59·5	30·0	14·7	44·2
III–XVI. All Manufacturing	3,736·8	4,978·8	178·8	236·6	2,503·9	2,818·6	2,485·2	1,206·4	800·8	2,079·6

THE STRUCTURE OF MACRO-ECONOMIC MODELS

I. Introduction

Various types of macro-dynamic economic models have been proposed during the past twenty-five years, notably by Kalecki (1935), Harrod (1939), Samuelson (1939), Kaldor (1940), Domar (1946), Hicks (1950), Goodwin (1951, 1955), Phillips (1954, 1957), Smithies (1957) and Duesenberry (1958). The main influence is Keynesian, and a general feature is that the economic relations are so simplified that econometric testing or estimation seems a very remote possibility. The object here is to classify the models from the economic angle (perhaps of some interest in itself), to examine their economic and lag structure and to begin the preparation of the ground so that, in the end, we may hope to pass the models to the statistician for testing and estimation of parameters.[1]

The models are constructed in two stages: the economic selection of the relations included and the technical specification of the lags in the relations. A good deal of attention has been paid to the first stage, much less to the second. We are familiar enough with the economic relations—with the form they take and with the parameters they include. We have much less idea about the appropriate form to assume for lags, about the lag parameters to insert. This is a kind of no-man's land. Economists in their model-building seem content, for the most part, to leave lag specification to the statistician—if the models ever get to the testing or estimation stage.[2] On the other hand, the statistician is likely (perhaps rightly) to refer the question back to the economist. What is a fairly typical view is that expressed by Smithies (1957):

> "I have arbitrarily assumed that the lag period in these relations [for full-capacity output] is the same as in the investment function. In a model that arrived at numerical results the two lag periods would each have to be estimated. The assumption of a single lag period, however, does not affect the validity of the model as a basis for qualitative discussion" (p. 21, footnote).

The contentions here are to the contrary—that the specification of lags is not just a matter of fixing the length of delay (*e.g.*, nine months as opposed to six months) and that the forms of the lags do affect the models, even for qualitative discussion.

[1] Nothing is said here about the more opportunist "econometric models" of the types associated with the names of Tinbergen, Klein and Goldberger.

[2] This is not altogether fair, since some economists (*e.g.*, Goodwin) are well aware of the problem. Moreover, Phillips' approach is such that he is much concerned with the issue. He does not construct economic models as such; he uses them to throw light on problems of economic stabilisation.

When both stages are complete the model may still be highly simplified, but it will be precise on exactly what parameters (economic and lag) are included. It will generally yield a deterministic solution (time-paths of the variables) which will depend in a known way on the values of the parameters. It should then be possible to look ahead towards the econometric testing of the model and the estimation of its parameters. The model would need to be amplified—by inclusion of further endogenous and exogenous influences, by specification of appropriate stochastic elements—but the way should be less obscure.

The treatment here is first to simplify the economic structure to the barest minimum in order to see clearly the influence of lags; and then to add to the economic content of the models. Even so, only typical and simplified models are considered, of kinds easily represented by schematic diagrams. For example, depreciation and obsolescence are complications which are assumed away; only net investment is considered. Another simplification is that no distinction is drawn between discrete and continuous formulations of the models. The discrete case is taken here, mainly because it is more familiar to the economist, if not to the mathematician. In fact, the difference between the two formulations is not great; the difference and differential equations which arise are handled in very similar ways and, apart from details, the solutions are the same.[1]

II. Multiplier Models

The simplest macro-dynamic model has only one economic relation: the multiplier. It serves as a basis for most models of greater sophistication, and it has been examined particularly by Phillips (1954, 1957) in relation to problems of economic stabilisation. The variables are in real terms, flows in period t: Y_t = output = income; Z_t = demand; C_t = consumption demand; A = autonomous investment (constant and given).

The schematic diagram [2] of Fig. 1 shows the relations of the model. There is only one economic parameter, the marginal propensity to consume c. Without lags:

$$Y_t = Z_t = C_t + A \quad \text{where} \quad C_t = cY_t \quad (0 < c < 1)$$

giving the static solution: $Y_t = \dfrac{A}{1-c}$ all t

This is the multiplier $\left(\dfrac{1}{1-c} > 1\right)$ and the simplest instance of a "feedback."

[1] It must not be taken for granted that discrete models are more "realistic" given data in statistical (discrete) form. The "period" of the discrete model has nothing to do with the timing of the statistics, as given in monthly, quarterly or annual series. Any model, whether in discrete or continuous form, produces time-paths of the variables which need to be "chopped up" into the accidental time intervals of the statistics.

[2] The diagrams follow suggestions made by Tustin (1953) rather than the more professional engineering form adopted by Phillips (1954, 1957). See Allen (1956), Chapter 9.

There are two lags to introduce. One is the supply lag L_1: supply Y_t lagging on demand Z_t. The other is the consumption lag L_2: consumption demand C_t lagging on income Y_t. The most general expression of the model is:

$$\left.\begin{array}{ll} \text{Supply:} & Y_t = (Z_t)_{L_1} = \text{lagged dependence on } Z_t \\ \text{Demand:} & Z_t = c(Y_t)_{L_2} + A = \text{lagged dependence on } Y_t \end{array}\right\} \quad . \quad (1)$$

The simplest possible case is when there is only one lag in the form of a

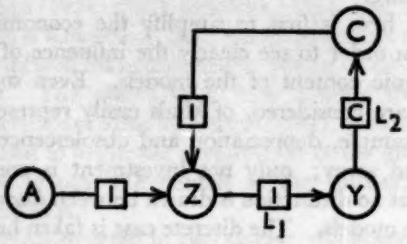

FIG. 1

one-period delay, *e.g.*, $L_1 = 1$, $L_2 = E^{-1}$, where E is the shift operator ($EY_t = Y_{t+1}$, $E^{-1}Y_t = Y_{t-1}$).

Then: $\quad Y_t = Z_t = C_t + A \quad$ where $\quad C_t = cEY_t = cY_{t-1}$

Here, as later, write $y_t = Y_t - \bar{Y}$ for deviations from the static level $\bar{Y} = \dfrac{A}{1-c}$ which is consistent with the model.

So: $\qquad y_t = cy_{t-1}$ with solution $y_t = y_0 c^t$

i.e., the simple dynamic multiplier with Y_t steadily damped ($0 < c < 1$) to $\bar{Y}$.

No lag parameters have yet been introduced. Consider cases where the two lags are of the same form, each involving one parameter. There is a variety of one-parameter forms to choose from, *e.g.*, the fixed-period delay: $Y_t = Z_{t-\theta}$ ($\theta > 0$). Two more general possibilities (shown for the supply lag) with a parameter $\mu (0 < \mu \leqslant 1)$ are:

Two-period moving average (distributed lag):

$$Y_t = (1-\mu)Z_t + \mu Z_{t-1} = (1 - \mu + \mu E^{-1})Z_t$$

Geometric lag: $Y_t = \mu\{Z_{t-1} + (1-\mu)Z_{t-2} + (1-\mu)^2 Z_{t-3} + \ldots\}$

$$= \mu E^{-1}\{1 + (1-\mu)E^{-1} + (1-\mu)^2 E^{-2} + \ldots\}Z_t$$

The simplest case of a one-period delay is got by setting $\mu = 1$ in either of these forms. The geometric lag, with Y_t dependent on *all* past values of Z_t, may look strange in this company. But the weighting coefficients, *i.e.*, $\mu, \mu(1-\mu), \mu(1-\mu)^2, \ldots$ adding to unity, have the particularly simple

form of a decreasing geometric series and only one parameter is needed to specify them. Moreover, it can be expressed in the difference operator $\Delta = E - 1$ (where $\Delta Y_t = Y_{t+1} - Y_t$) to give:

$$Y_t = \frac{\mu}{\Delta + \mu} Z_t \quad \text{or} \quad \Delta Y_t = \mu(Z_t - Y_t)$$

with the interpretation that the increase in Y_t is always a fixed proportion of the current deficit $(Z_t - Y_t)$ due to the lag.[1]

In the model (1) write $y_t = Y_t - \bar{Y}$ and $z_t = Z_t - \bar{Z}$ for deviations from the static level $\bar{Y} = \bar{Z} = \frac{A}{1 - c}$. As one case, take L_1 as a two-period moving average lag with parameter μ and L_2 as a similar lag with parameter v:

$$y_t = (1 - \mu)z_t + \mu z_{t-1} \quad \text{and} \quad z_t = (1 - v)cy_t + vcy_{t-1}$$

The reduced or recursive form is:

$$\left.\begin{aligned} y_t &= \frac{1}{C}\{v(1 - \mu)cy_{t-1} + \mu z_{t-1}\} \\ z_t &= \frac{1}{C}\{vcy_{t-1} + \mu(1 - v)cz_{t-1}\} \end{aligned}\right\} \quad . \quad . \quad (2a)$$

where $C = 1 - (1 - \mu)(1 - v)c$. As a second case, take L_1 and L_2 as geometric lags with parameters μ and v respectively:

$$y_t = \frac{\mu}{\Delta + \mu} z_t \quad \text{and} \quad z_t = \frac{v}{\Delta + v} cy_t$$

which give the reduced or recursive form:

$$\left.\begin{aligned} y_t &= (1 - \mu)y_{t-1} + \mu z_{t-1} \\ z_t &= vcy_{t-1} + (1 - v)z_{t-1} \end{aligned}\right\} \quad . \quad . \quad . \quad (2b)$$

The equations of the model, either (2a) or (2b), are a pair of linear difference equations in y_t and z_t. The solution (see Technical Note B) is that y_t and z_t satisfy the same autoregressive relation, a second-order difference equation. In general, the time-paths of the variables can be steady or oscillatory, damped or anti-damped, according to the values of the parameters; but with the present parameters (c, μ and v, all positive fractions) the typical solution has Y_t as the sum of two real terms. The dominant term is again steadily damped to $\bar{Y}$ and the other term is a more heavily damped alternation:

$$Y_t = B_1\lambda_1^t + B_2(-\lambda_2)^t \quad (0 < \lambda_2 < \lambda_1 < 1)$$

[1] See Technical Note C. The geometric lag was suggested by Koyck (1954) for such economic relations as consumption or investment; see also Klein (1958). It may seem odd that the geometric lag taken here begins with Z_{t-1} (*i.e.*, after a one-period delay) instead of with Z_t. But, in the latter case:

$$Y_t = \mu\{Z_t + (1 - \mu)Z_{t-1} + (1 - \mu)^2Z_{t-2} + \ldots\} \text{ giving } Y_t = \frac{\mu}{\Delta + \mu} Z_{t+1}$$

This is not quite so simply interpreted, but the difference in practice is largely incidental.

where B_1 and B_2 are given by initial conditions. The time-path of Z_t is similar and (in the limit as t increases) Z_t is a multiple of Y_t, the multiple here being nearly unity.

In general, the lags involve several parameters, *e.g.*, a moving average (distributed lag) of three or more periods, or a multiple geometric lag comprising two or more geometric lags applied in succession. To illustrate, with double geometric lags, (1) becomes:

$$y_t = \frac{\mu_1\mu_2}{(\Delta+\mu_1)(\Delta+\mu_2)}\, z_t \quad \text{and} \quad z_t = \frac{v_1v_2}{(\Delta+v_1)(\Delta+v_2)}\, cy_t$$

which gives the reduced or recursive form:

$$\left.\begin{aligned} y_t &= (2-\mu_1-\mu_2)y_{t-1} - (1+\mu_1\mu_2-\mu_1-\mu_2)y_{t-2} + \mu_1\mu_2 z_{t-2} \\ z_t &= v_1v_2cy_{t-2} + (2-v_1-v_2)z_{t-1} - (1+v_1v_2-v_1-v_2)z_{t-2} \end{aligned}\right\} \quad (3)$$

In solving (3), as compared with (2b), the common relation satisfied by y_t and z_t is a difference equation of the fourth order. The range of possibilities for the time-paths is greatly increased.

It is clear, as Phillips (1957) has shown in his continuous formulation, that the more complicated the lags, the higher the order of the difference equation satisfied by the variables and the greater the range of possibilities for their time-paths. In particular, oscillatory and explosive time-paths become more likely. Notice, also, that there is no necessary link between the number of parameters (economic and lag) and the number of coefficients, which might be subject to statistical estimation, in the difference equations (1). In (2b) there are four coefficients in three parameters; in (3) there are six coefficients in five parameters. There happens to be a deficiency of parameters in this model. The point clearly needs to be watched.

III. Accelerator Models

More sophisticated models based on the multiplier can be generally classified into two types. The first type is the accelerator model, characterised by an investment relation which depends on the rate of change of output and in which the capital stock does not appear explicitly (as an endogeneous variable). The second type is the capital–output model, in which investment is made to depend, directly or indirectly, on the level of output and on the capital stock. Simplified but typical versions of the two models are here considered in turn.

Accelerator models have a long history, both as generating growth, as with Harrod (1939) and Domar (1946), and as giving rise to oscillations, as with Samuelson (1939) and Hicks (1950). The variables are as before, together with:

$$I_t = \text{investment demand}$$

and there are two economic parameters, the marginal propensity to consume

c, and the power of the accelerator v. The relations of the model are shown in the schematic diagram of Fig. 2. Without lags:

$$Y_t = Z_t = C_t + I_t + A \quad \text{where} \quad C_t = cY_t \qquad (0 < c < 1)$$
$$\text{and} \quad I_t = v(1 - E^{-1})Y_t = v(Y_t - Y_{t-1}) \quad (v > 0)$$

Write $\rho = \dfrac{1-c}{v}$ (typically $0 < \rho < 1$) and $y_t = Y_t - \bar{Y}$ as before $\left(\bar{Y} = \dfrac{A}{1-c}\right)$:

$$y_t = \frac{1}{1-\rho} y_t \quad \text{with solution} \quad y_t = y_0\left(\frac{1}{1-\rho}\right)^t$$

This is the typical Harrod–Domar growth model, the rate of growth being given by $\left(\dfrac{1}{1-\rho}\right)$.

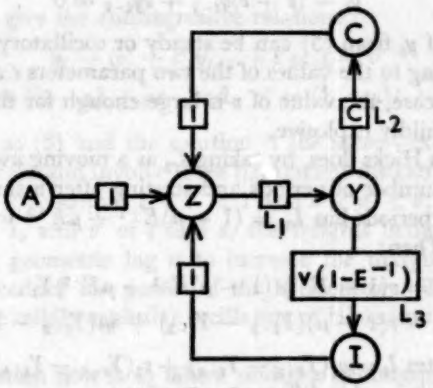

FIG. 2

There are three lags to be inserted: the supply lag L_1, the consumption lag L_2 and the investment lag L_3. The general model is:

$$\left.\begin{array}{l} \text{Supply: } Y_t = (Z_t)_{L1} = \text{lagged dependence on } Z_t \\ \text{Demand: } Z_t = c(Y_t)_{L2} + v(1 - E^{-1})(Y_t)_{L3} + A \\ \qquad\qquad = \text{lagged dependence on } Y_t \end{array}\right\} \quad . \quad . \quad . \quad (4)$$

The parameters comprise two economic parameters (c and v) and as many lag parameters as are considered necessary in specifying the three lags. There is no way of keeping (4) down to a pair of linear difference equations like (2a) or (2b), except by taking no lag in the accelerator ($L_3 = 1$). This is generally to be avoided; investment should be dependent, at least, on the output increase of the previous period. The difference between the multiplier and accelerator models (1) and (4) is that the demand relation of the accelerator model has one more economic parameter and (for lags of the same kind) it is a difference equation of the next higher order. The time-paths of the variables, other things being equal, are more complicated.

Some simple cases make this general conclusion more specific. The starting-point is the steady growth of the model without lags. Take no lag in supply ($L_1 = 1$) and a single-period delay in consumption ($L_2 = E^{-1}$). The lag in the accelerator (L_3) is to be specified in terms of suitable lag parameters.

(i) Take $L_3 = E^{-1}$, *i.e.*, a single-period delay in investment (a specific lag, without a parameter). This is the elementary case of Hicks (1950). The model is:

$$Y_t = Z_t = C_t + I_t + A \quad \text{where} \quad C_t = cE^{-1}Y_t = cY_{t-1}$$
$$\text{and} \quad I_t = v(1 - E^{-1})E^{-1}Y_t = v(Y_{t-1} - Y_{t-2})$$

The result is an autoregressive relation for y_t, the second-order difference equation:

$$y_t - (v + c)y_{t-1} + vy_{t-2} = 0 \quad . \quad . \quad . \quad (5)$$

The time-path of y_t from (5) can be steady or oscillatory, damped or anti-damped, according to the values of the two parameters c and v. Typically, in this Hicksian case, the value of v is large enough for the time-path to be oscillatory and mildly explosive.

Generalise, as Hicks does, by taking L_3 as a moving average (distributed lag) of a small number of periods and starting after a single-period delay.[1] The case of two periods has $L_3 = (1 - \mu)E^{-1} + \mu E^{-2}$ with one parameter $(0 < \mu \leqslant 1)$. Then:

$$I_t = v(1 - E^{-1})\{(1 - \mu)E^{-1} + \mu E^{-2}\}Y_t$$

i.e.,

$$I_t = v(1 - \mu)(Y_{t-1} - Y_{t-2}) + v\mu(Y_{t-2} - Y_{t-3})$$

which Hicks writes $I_t = v_1(Y_{t-1} - Y_{t-2}) + v_2(Y_{t-2} - Y_{t-3})$ with $v_1 + v_2 = v$. The result is a third-order difference equation:

$$y_t + a_1y_{t-1} + a_2y_{t-2} + a_3y_{t-3} = 0 \quad . \quad . \quad . \quad (6)$$

where the three coefficients are given in terms of the three parameters (c, v and μ) of the model. The time-path of Y_t is now typically an oscillation combined with a steady or alternating component. As the length of the moving average (distributed lag) is increased, the difference equation (6) takes in more terms to match the larger number of parameters, and the time-path of Y_t is a more complicated blend of oscillatory, alternating and steady components.

The result is quite neat in this simple case. The basic model, without lags, has a steady growth given by the two economic parameters c and v.

[1] The general moving average lag is $\mu_0 + \mu_1E^{-1} + \mu_2E^{-2} + \ldots + \mu_rE^{r}$ with $\sum_{i=0}^{r} \mu_i = 1$. The case analysed here has $\mu_0 = 0$ and $r = 2$, a single-period delay followed by an average over two subsequent periods. The general Hicksian case is:

$$I_t = v_0(Y_t - Y_{t-1}) + v_1(Y_{t-1} - Y_{t-2}) + v_2(Y_{t-2} - Y_{t-3}) + \ldots \quad (\Sigma v_i = v)$$

with $v_0 = 0$ to omit the first term.

With lags of delayed moving average type, the order of the difference equation for Y_t always equals the number of parameters—and the oscillatory and non-oscillatory components of the time-path of Y_t increase in variety as the length of the lag is made greater.

(ii) The same kind of autoregressive relation for Y_t can be obtained for accelerator lags of other forms. A simple case is that of a geometric lag, not examined by Hicks. Take:

$$L_3 = \frac{\mu}{\Delta + \mu} \text{ with one parameter } (0 < \mu \leqslant 1) \text{ and } \Delta = E - 1$$

So: $$Y_t = Z_t = C_t + I_t + A \quad \text{where} \quad C_t = cE^{-1}Y_t = cY_{t-1}$$

$$\text{and} \quad I_t = v(1 - E^{-1}) \frac{\mu}{E - (1 - \mu)} Y_t$$

which is found to give the autoregressive relation:

$$y_t - (v' + c')y_{t-1} + v'y_{t-2} = 0$$

where $$c' = (1 - \mu) + \mu c \quad \text{and} \quad v' = (1 - \mu)c + \mu v$$

This is the same as (5) and the solution is the same—except that the coefficients are different and involve three parameters instead of two. Usually $0 < c < 1$ and $c < v$, so that $c < c' < 1$ and $c < v' < v$; c' is a weighted average of c and 1, and v' of c and v, the weights being $(1 - \mu)$ and μ. The effect of the geometric lag is to increase the marginal propensity to consume and to reduce the power of the accelerator. This may well be enough to turn the mildly explosive oscillation of Hicks into a mildly damped one.

The generalisation now is to take a multiple geometric lag with several parameters. For example, when L_3 is a double geometric lag with parameters μ_1 and μ_2, the difference equation for y_t is of third-order form (6) with three coefficients given by four parameters (c, v, μ_1 and μ_2). The result is much the same as in (i), except that there is a surplus of parameters.

The case of no supply lag, of which two versions have been analysed, is characterised by the fact that the pair of lagged relations (4) reduces to a single autoregressive relation for Y_t, such as (5) or (6). It may be possible, by being partly specific in the lags, to keep the number of parameters down to the number of the cofficients in this relation. More generally, however, there are more parameters than coefficients. This need not be a difficulty in econometric testing and estimation. For, with no lag in supply, C_t and I_t are both realised as actual consumption and investment, *i.e.*, they are separately observable.

The situation is complicated by the presence of a supply lag. There are two lagged relations (4), but, though output Y_t is observable, the other variable, demand Z_t, is not. Further, since total demand is not currently realised ($Y_t \neq Z_t$), this is also true of one or other (or both) of consumption

and investment demand. In particular, I_t is not necessarily associated with actual investment, with the growth of capital stock or with any observable series. An aggregate model of this type, in which there is a supply lag, is not immediately decomposable into sub-aggregates.

These complications arise in attempts to introduce " realistic " lags in supply and in other relations of the model. They are quite apart from other complications, again in the interests of " realism," when non-linear forms are taken for the accelerator, as by Goodwin (1951).

IV. Capital–Output Models

Smithies (1957) and Duesenberry (1958) have recently made much use of models of this type, but they go back to earlier work, *e.g.*, by Kalecki

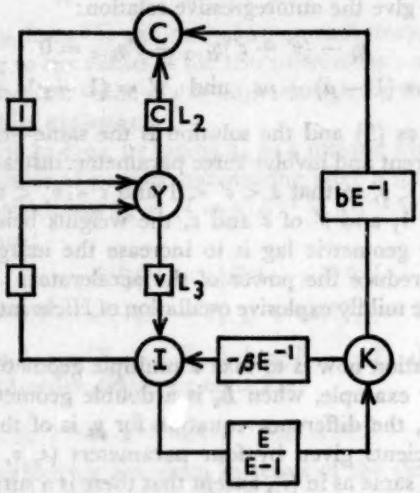

Fig. 3

(1935) and Kaldor (1940). Goodwin (1955) has a model of this general type, but more explicitly related to the accelerator and with a non-linear relation. There are further models, *e.g.*, Phillips (1957), in which capital stock is confined to inventories.

First, assume no lag on the supply side and take the simplified model of Duesenberry, shorn of its depreciation element, as the type. To the flow variables already used, a stock variable is added:

K_t = capital stock at end of period t

The schematic diagram of Fig. 3 shows the relations of the model. There are four parameters: c and v for the influence of output (income), b and β

for that of capital stock (at the end of the previous period) on consumption and investment. Without lags:

$$Y_t = C_t + I_t \text{ where } C_t = cY_t + bE^{-1}K_t = cY_t + bK_{t-1} \ (0 < c < 1, b > 0)$$
$$\text{and } I_t = vy_t - \beta E^{-1}K_t = vY_t - \beta K_{t-1} \ (v > 0, \beta > 0)$$

together with a technical relation (identity) on capital growth:

$$K_t - K_{t-1} = I_t \quad \text{or} \quad K_t = \frac{E}{E-1} I_t$$

The effect of capital stock is taken as positive on consumption, through profits and dividends, but as negative on investment, through the marginal efficiency of capital. Write $\rho = 1 - \beta + kv$ where $k = (b - \beta)/(1 - v - c)$ and the relations give:

$$Y_t = kK_{t-1} \quad \text{and} \quad K_t = \rho K_{t-1}$$
with solution: $$Y_t = kK_0\rho^{t-1} \quad \text{and} \quad K_t = K_0\rho^t$$

where K_0 is the original capital stock. This is again a typical growth model, capital stock growing at a rate given by ρ and the capital–output ratio being constant. This ratio can be expressed: $Y_t/K_{t-1} = k$, *i.e.*, output is a fixed multiple of capital stock at the end of the previous period. The ratio is not a technical one; it arises from the actual time-paths of capital and output generated by the model (Technical Note A).

It is reasonable to take no lag in the effect of capital stock (K_t) on consumption and investment in the subsequent period. There are then two lags to insert, in the output effects on consumption (L_2) and on investment (L_3). The general model is:

$$\left.\begin{aligned} \text{Supply/Demand: } Y_t &= c(Y_t)_{L2} + v(Y_t)_{L3} + (b - \beta)K_{t-1} \\ &= \text{lagged dependence on } Y_t \text{ and } K_{t-1} \\ \text{Technical: } K_t &= I_t + K_{t-1} = v(Y_t)_{L3} + (1 - \beta)K_{t-1} \\ &= \text{lagged dependence on } Y_t \text{ and } K_{t-1} \end{aligned}\right\} \quad . \quad (7)$$

There are four economic parameters and whatever lag parameters are used for L_2 and L_3.

The simplest case has $L_2 = L_3 = E^{-1}$, one-period delays in consumption and investment. This is Duesenberry's simplified model and effectively that of Smithies.[1] Then (7) are:

$$\left.\begin{aligned} Y_t &= (v + c)Y_{t-1} + (b - \beta)K_{t-1} \\ K_t &= vY_{t-1} + (1 - \beta)K_{t-1} \end{aligned}\right\} \quad . \quad . \quad (8)$$

[1] The model of Smithies (1957) uses full-capacity output Y_f as a variable instead of capital stock K. A translation from Smithies to Duesenberry, or conversely, can be made by means of a technical relation: $Y_f = \sigma K$, where σ is Domar's coefficient (see Technical Note A). In Smithies' State 1 the relations are (8) with different parameters and Y_f instead of K; the solution is as indicated here. In addition, he has a State 2, which is characterised by relations of type (8) with a constant term (in past peak income $\bar{Y}$) added to each. A corresponding particular integral, again a constant in terms of $\bar{Y}$, is then to be added to the solution (see Technical Note B).

This is a pair of linear first-order difference equations in two variables, in reduced or recursive form, and with four coefficients given in terms of four parameters. The model is neat and convenient (*e.g.*, for estimation purposes)—as a result of the fact that the lags are specified as one-period delays. The solution (Technical Note B) is that both the variables, Y_t and K_t, satisfy the same autoregressive relation:

$$Y_t - (v + c + 1 - \beta)Y_{t-1} + \{(v + c)(1 - \beta) - v(b - \beta)\}Y_{t-2} = 0 . \quad (9)$$

and that the closely related time-paths of Y_t and K_t may be steady or oscillatory, damped or anti-damped, according to the values of the parameters. Typically, in the Duesenberry model, the variations are steady growths, and the time-paths can be written:

$$\begin{aligned} Y_t &= B_1\lambda_1^t + B_2\lambda_2^t \\ K_t &= k_1B_1\lambda_1^t + k_2B_2\lambda_2^t \end{aligned} \qquad (\lambda_1 > \lambda_2 > 1)$$

where λ_1, λ_2, k_1 and k_2 are constants fixed by the parameters of (8) and where B_1 and B_2 are given by initial conditions. There are two steady-growth situations:

$$\begin{aligned} Y_t &= Y_0\lambda_1^t \quad \text{and} \quad K_t = k_1Y_t \quad (\text{when } B_2 = 0) \\ Y_t &= Y_0\lambda_2^t \quad \text{and} \quad K_t = k_2Y_t \quad (\text{when } B_1 = 0) \end{aligned}$$

The general solution is a combination of these two situations. The capital–output ratio K_t/Y_t is constant in each situation and, generally, the ratio tends to k_1 in the limit as time goes on. The constancy of the capital–output ratio is again not a technical matter. Nor is it accidental. It is a consequence of the structure of the model as expressed in the linear first-order equations (8)—a built-in feature of any model (such as Duesenberry's or Smithies') which has such relations.[1]

The consequences of introducing other and more complicated lags in the system (7) are similar to those already described. For example, if no more is done than to insert the geometric lag $L_3 = \frac{\mu}{\Delta + \mu}$ in the investment

[1] Duesenberry claims that the elementary accelerator model of Hicks is a special case of his model with relations (8), putting $b = 0$ and $\beta = 1$. The autoregressive relation of Duesenberry, (9) above, does indeed become:

$$Y_t - (v + c)Y_{t-1} + vY_{t-2} = 0$$

which is Hicks' relation, (5) above. But there is a little more to it than this. Hicks' model has no supply lag, so that I_t is actual investment, giving:

$$K_t - K_{t-1} = I_t = v(Y_{t-1} - Y_{t-2})$$

for change in capital stock. Hicks' model need go no farther; nothing is said explicitly about the level of capital stock, or about the capital–output ratio. It is not necessary that $K_t = vY_{t-1}$ as required by Duesenberry's (8) with $\beta = 1$. However, it is possible to add an extra assumption to Hicks' model—that actual capital stock is always equal to desired capital stock, given technically by: $\bar{K} = vY_{t-1}$. Then:

$$K_t = vY_{t-1} \quad \text{and} \quad K_t - K_{t-1} = v(Y_{t-1} - Y_{t-2})$$

are both valid and the link with the accelerator is complete.

relation, then (7) no longer give the simple equations (8). They become of second order:

$$Y_t = a_{11}Y_{t-1} + a_{12}Y_{t-2} + a_{13}K_{t-1} + a_{14}K_{t-2}$$
$$K_t = a_{21}Y_{t-1} \qquad\qquad + a_{23}K_{t-1} + a_{24}K_{t-2}$$

The seven coefficients are here given in terms of five parameters (c, v, b, β, μ). The autoregressive relation (9) becomes a third-order difference equation in Y_t, from which growth and oscillatory components of the time-path of Y_t are to be expected. Duesenberry introduces fluctuations into his simple growth model (8) by taking the parameters as shifting over time. This may well be appropriate, but he can also get some of the complications

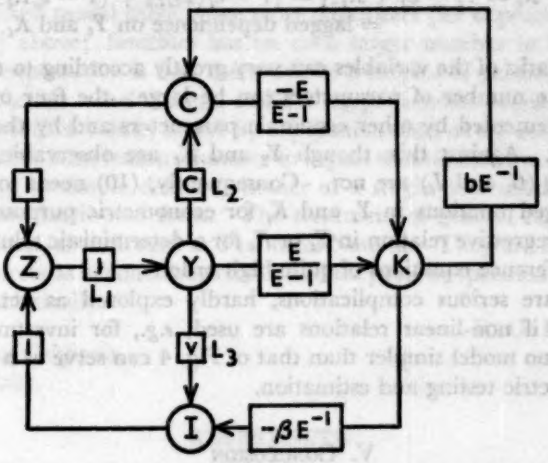

FIG. 4

he wants (and some he does not) by the simple and "realistic" device of replacing his one-period delays by more suitable lags. The number of parameters will be larger and not necessarily equal to the number of coefficients in the relations of the system. The solution of the model—the time-paths of Y_t and K_t, their growth and oscillatory features—will vary with the types of lags included.

Now assume that there is a supply lag. The schematic diagram of the relations of the model needs to be adjusted as in Fig. 4. The variables Y_t and Z_t are shown separately, and the technical relation on capital growth is changed to match. The relation $K_t - K_{t-1} = I_t$ is valid only if I_t is actual investment as well as investment demand—correct in the absence of a supply lag but not necessarily so when output lags behind demand. What relation to substitute depends on an additional assumption. It is taken here that consumption demand is realised, that investment absorbs all surplus or

short-fall in output, *e.g.*, in the form of unintended inventories.[1] Since actual investment is then $(Y_t - C_t)$, the technical relation is:

$$K_t - K_{t-1} = Y_t - C_t \neq I_t \text{ or } K_t = \frac{E}{E-1}(Y_t - C_t)$$

This is shown in Fig. 4. Inserting three lags, including the supply lag L_1, we find that the model is characterised by three relations in three variables Y_t, Z_t and K_t:

$$\left.\begin{aligned}
&\text{Supply: } Y_t = (Z_t)_{L1} = \text{lagged dependence on } Z_t \\
&\text{Demand: } Z_t = c(Y_t)_{L2} + v(Y_t)_{L2} + (b-\beta)K_{t-1} \\
&\qquad = \text{lagged dependence on } Y_t \text{ and } K_{t-1} \\
&\text{Technical: } K_t = Y_t - C_t + K_{t-1} = (1-c)(Y_t)_{L2} + (1-b)K_{t-1} \\
&\qquad = \text{lagged dependence on } Y_t \text{ and } K_{t-1}
\end{aligned}\right\} \quad (10)$$

The time-paths of the variables can vary greatly according to the lag forms taken. The number of parameters can be large; the four used here are to be supplemented by other economic parameters and by the parameters of the lags. Against this, though Y_t and K_t are observable, Z_t and its components (C_t and I_t) are not. Consequently, (10) needs to be reduced to two lagged relations in Y_t and K_t for econometric purposes—and to a single autoregressive relation in Y_t or K_t for a deterministic solution. These may be difference equations of quite high order.

These are serious complications, hardly explored as yet. They are aggravated if non-linear relations are used, *e.g.*, for investment. Yet it seems that no model simpler than that of Fig. 4 can serve as a basic system for econometric testing and estimation.

V. Conclusion

A macro-dynamic model of the type considered involves two or more lagged and interdependent relations in two or more variables. A deterministic solution is obtained by reducing the system to an autoregressive relation in a selected variable. Other reductions of the system may be needed for econometric purposes. The parameters of the model may be numerous and not necessarily identified in terms of the coefficients of the relations. But the time-paths of the variables depend on the values of the parameters, and they are affected by any temporal shifts in the parameters. Some studies are now becoming available,[2] but much remains to be done, not only on the formulation of economic relations but particularly on realistic specification of lags. It is still too much to ask the statistician to test or estimate parameters in such economic models.

[1] This is the usual assumption, but it is not always made explicit. It is the assumption made by Phillips (1957) in his inventory model, a good example of a capital-output model with a lag on the supply side.

[2] See Eisner (1959) and Klein (1958).

The following are among the questions which need to be put. First, what form of lag is realistic? Is it a moving average (distributed lag) of several periods? Noting that the order of the difference equations of the model grows alarmingly as the lags are lengthened, how few periods can be taken? This has a bearing on recent work in which a distinction is drawn, in consumption or investment relations, between permanent and temporary increases in output or income (considered over many periods). Or, can some simple approximation (*e.g.*, a geometric lag) be used and, if so, with how few parameters?

Second, with the form of the economic and lag relations decided, how many parameters are there in all for estimation? It is only too easy to increase the number of economic parameters in a model. Even in Duesenberry's simplified model there is one more parameter (for depreciation) than shown in (8) above; Smithies has an even larger number in his version. The general expectation is that there will be a surplus of parameters. The question is whether some of them, and the lag parameters in particular, can be allotted specified values, found by experimentation or by other means.

Finally, there is no reason whatever to expect that realism can be achieved by taking lags as simple delays (whether of a single or a variable period) rather than in distributed form. The treatment of general lags is in any case not difficult, as indicated in Technical Note C. They are handled just as well in discrete as in continuous form, and they can be specified empirically as well as analytically.

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REFERENCES

Allen, R. G. D. (1956): *Mathematical Economics* (Macmillan, 1956).
Domar, E. D. (1946): "Capital Expansion, Rate of Growth, and Employment," *Econometrica*, April 1946.
Duesenberry, J. S. (1958): *Business Cycles and Economic Growth* (McGraw-Hill, 1958).
Eisner, R. (1959): "A Distributed Lag Investment Function" (to be published).
Goodwin, R. M. (1951): "The Non-linear Accelerator and the Persistence of Business Cycles," *Econometrica*, January 1951.
Goodwin, R. M. (1955): "A Model of Cyclical Growth," in Lundberg (Ed.), *The Business Cycle in the Post-war World* (Macmillan, 1955).
Harrod, R. F. (1939): "An Essay in Dynamic Theory," ECONOMIC JOURNAL, March 1939.
Harrod, R. F. (1948): *Towards a Dynamic Economics* (Macmillan, 1948).
Hicks, J. R. (1950): *A Contribution to the Theory of the Trade Cycle* (Oxford, 1950).
Kaldor, N. (1940): "A Model of the Trade Cycle," ECONOMIC JOURNAL, March 1940.
Kalecki, M. (1935): "A Macrodynamic Theory of Business Cycles," *Econometrica*, July 1935.
Klein, L. R. (1958): "The Estimation of Distributed Lags," *Econometrica*, October 1958.

Koyck, L. M. (1954): *Distributed Lags and Investment Analysis* (North-Holland, Amsterdam, 1954).
Phillips, A. W. (1954): "Stabilisation Policy in a Closed Economy," ECONOMIC JOURNAL, June 1954.
Phillips, A. W. (1957): "Stabilisation Policy and the Time-forms of Lagged Response," ECONOMIC JOURNAL, June 1957.
Samuelson, P. A. (1939): "Interactions between the Multiplier Analysis and the Principle of Acceleration," *Review of Economic Statistics*, May 1939.
Smithies, A. (1957): "Economic Fluctuations and Growth," *Econometrica*, January 1957.
Tustin, A. (1953): *The Mechanism of Economic Systems* (Heinemann, 1953).

TECHNICAL NOTES

A. CAPITAL–OUTPUT RATIOS

The ratio of capital stock K to output Y follows from the time-paths of the two variables. It is not technically determined; it is a consequence of the structure of the particular model considered. If the ratio is constant over time, then it is because the model has been assumed to have a particular structure. The ratio, however, may be confused with one or other of two *technical* ratios which are sometimes assumed to be given and/or constant.

(a) *Desired Capital/Output Ratio:* $v = \dfrac{\bar{K}}{Y}$ (v = acceleration coefficient)

In discrete analysis, the technical relation (v constant) is $\bar{K}_t = vY_t$ without lag, *i.e.*, desired capital stock at the end of period t is proportional to output in the period. If a lag is introduced, it can only be $\bar{K}$ lagged on Y: $\bar{K}_t = vY_{t-1}$. To interpret a constant v as the power of the accelerator, it is necessary to say something about actual as well as desired capital stock. Assume that actual capital stock is always the same as that desired. Then $K_t = \bar{K}_t = vY_t$ gives:

$$I_t = K_t - K_{t-1} = v(Y_t - Y_{t-1})$$

which is the accelerator relation.

(b) *Full-capacity Output–Capital Ratio:* $\sigma = \dfrac{Y_f}{K}$ (σ = Domar's coefficient)

In discrete analysis, the technical relation (σ constant) is $Y_{ft} = \sigma K_t$ without lag, *i.e.*, full-capacity output in period t is proportional to capital stock at the end of the period. If a lag is introduced, as indeed would be usual, it can only be Y_f lagged on K: $Y_{ft} = \sigma K_{t-1}$. Here, σ is not the reciprocal of the acceleration coefficient; it expresses only the technical fact that full-capacity output is fixed by the capital stock. The confusion arises since (σ constant, one-period lag):

$$I_t = K_t - K_{t-1} = \frac{1}{\sigma}(Y_{ft+1} - Y_{ft})$$

This is not an accelerator relation—the lag is in the opposite direction. It is simply the same technical relation in difference form:

$$Y_{ft+1} - Y_{ft} = \sigma I_t$$

i.e., the change in full-capacity output is proportional to the (prior) investment.

B. Systems of Linear Difference Equations

The problem is sufficiently illustrated by considering a pair of first-order difference equations in two variables Y_t and Z_t. In homogeneous form:

$$\left.\begin{aligned}\alpha_{11}Y_t + \alpha_{12}Z_t + \beta_{11}Y_{t-1} + \beta_{12}Z_{t-1} = 0\\ \alpha_{21}Y_t + \alpha_{22}Z_t + \beta_{21}Y_{t-1} + \beta_{22}Z_{t-1} = 0\end{aligned}\right\} \quad \text{(i)}$$

Provided that the matrix of α's is not singular, the equations can be solved for Y_t and Z_t to give the reduced or recursive form:

$$\left.\begin{aligned}Y_t = a_{11}Y_{t-1} + a_{12}Z_{t-1}\\ Z_t = a_{21}Y_{t-1} + a_{22}Z_{t-1}\end{aligned}\right\} \quad \text{(ii)}$$

where the a's are given in terms of the α's and β's. It is better to consider the reduced form (ii) with four parameters, rather than the form (i) originally specified.

The variables in the simple system (i) or (ii) are very closely related. The relation can be expressed in one or other of two equivalent ways:

(a) *The Variables Satisfy the Same Autoregressive Relation*

Multiply the equations (ii) by a_{22} and a_{12} respectively and subtract:

$$a_{12}Z_t = a_{22}Y_t - AY_{t-1} \qquad \text{where} \qquad A = \begin{vmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{vmatrix}$$

Then $$a_{12}Z_{t-1} = a_{22}Y_{t-1} - AY_{t-2}$$

can be substituted into the first equation of (ii) to give:

$$Y_t - (a_{11} + a_{22})Y_{t-1} + AY_{t-2} = 0 \quad \text{(iii)}$$

On eliminating Z_t, the system (ii) is reduced to the autoregressive relation (iii) in Y_t. Similarly, on eliminating Y_t, it reduces to exactly the same relation in Z_t.

(b) *The Variables Have a Particular (Constant) Relationship*

The deterministic solution of the system (ii) is given by the difference equation (iii). More directly, try:

$$Y_t = \lambda^t \quad \text{and} \quad Z_t = k\lambda^t$$

in (ii) and find appropriate constants λ and k. Substitution in (ii) gives:

$$k = \frac{\lambda - a_{11}}{a_{12}} = \frac{a_{21}}{\lambda - a_{22}}$$

λ is given by the quadratic:

$$\lambda^2 - (a_{11} + a_{22})\lambda + A = 0$$

or

$$\begin{vmatrix} a_{11} - \lambda & a_{12} \\ a_{21} & a_{22} - \lambda \end{vmatrix} = 0$$

Hence, there are two values of λ, the characteristic roots (λ_1 and λ_2) of A. The corresponding values of k are:

$$k_1 = \frac{\lambda_1 - a_{11}}{a_{12}} \quad \text{and} \quad k_2 = \frac{\lambda_2 - a_{11}}{a_{12}}$$

The values of the λ's and the k's are thus provided by the structure of the model, the coefficients in (ii). If λ_1 and λ_2 are real ($\lambda_1 > \lambda_2$), the solution of (ii) is:

$$\left.\begin{aligned} Y_t &= B_1\lambda_1^t + B_2\lambda_2^t \\ Z_t &= k_1B_1\lambda_1^t + k_2B_2\lambda_2^t \end{aligned}\right\} \quad . \quad . \quad . \quad \text{(iv)}$$

where B_1 and B_2 are given by initial conditions. In the limit as t increases, the first term in each of these expressions is dominant. The ratio of Z_t to Y_t tends to be a constant k_1, depending only on the structure of the system (and not on initial conditions).

If the λ's are conjugate complex, the time-paths (iv) are oscillatory:

$$Y_t = B\rho^t \cos(\theta t - \varepsilon) \quad \text{and} \quad Z_t = \kappa B\rho^t \cos(\theta t - \varepsilon')$$

where ρ, θ and κ are structural constants given by the coefficients in (ii) and where B, ε and ε' depend also on initial conditions. The time-paths of the variables have the same frequency and damping but with amplitude and phasing dependent on initial conditions. But the amplitude of the oscillation in Z_t is a constant multiple of that in Y_t, the constant being given by the structure of the system.

If the system is not homogeneous, a term in t being added to each equation in (i) or (ii), then the solution is (iv) with the addition of a particular integral. For example, add constant terms $r\bar{Y}$ and $s\bar{Z}$ in (ii) so that the solution (iv) has constants $R\bar{Y}$ and $S\bar{Z}$ added to the two equations respectively, where R and S are constants given by r, s and the a's.

This treatment of difference equations is analogous to the corresponding (and better-known) analysis for differential equations. The equations in reduced form:

$$\frac{dY}{dt} = a_{11}Y + a_{12}Z \quad \text{and} \quad \frac{dZ}{dt} = a_{21}Y + a_{22}Z$$

show that Y and Z satisfy the same autoregressive relation:

$$\frac{d^2Y}{dt^2} - (a_{11} + a_{22})\frac{dY}{dt} + AY = 0$$

and $$Y = B_1e^{\lambda_1 t} + B_2e^{\lambda_2 t} \quad \text{and} \quad Z = k_1B_1e^{\lambda_1 t} + k_2B_2e^{\lambda_2 t}$$

The interpretation of the constants here is exactly the same as that given above for difference equations.

C. General Treatment of Lags

The variables (Y, Z, K, . . .) of a macro-dynamic model are inter-related and the responses are lagged. Suppose that Y has a lagged dependence on Z. In the continuous case the Laplace Transform is a powerful tool for handling the general lag:

$$Y(t) = \int_0^\infty w(\tau)Z(t-\tau)d\tau \quad \text{where} \quad \int_0^\infty w(t)dt = 1 \quad . \quad . \quad \text{(i)}$$

The weighting function $w(t)$ of the lag must be specified either empirically or analytically in terms of lag parameters. Write the one-sided Laplace Transform of $w(t)$:

$$W(p) = \int_0^\infty e^{-pt}w(t)dt$$

Then the lagged relation (i) reduces to the differential equation:

$$Y = W(D)Z \quad \left(\text{Operator } D = \frac{d}{dt}\right) \quad . \quad . \quad . \quad \text{(ii)}$$

Usually, by the way in which Laplace Transforms appear, the function $W(p)$ is the ratio of polynomials in p, and (ii) is linear with constant coefficients.

In the discrete case, the general form of the lagged relation is:

$$Y_t = \sum_{r=0}^{\infty} w_r Z_{t-r} \text{ where } \sum_{r=0}^{\infty} w_r = 1 \quad . \quad . \quad . \quad \text{(iii)}$$

The weighting coefficients w_r ($r = 0, 1, 2, \ldots$) must be specified empirically or analytically. If $w_r = 0$ for $r \geqslant R$, then (iii) is the sum of a finite number R of terms and the lagged relation is of moving average (distributed) form. More generally (iii) has an infinite series of weighting coefficients. An appropriate transform, analagous to the Laplace Transform of the continuous case, can then be used. It is provided by the Generating Function of w_r:

$$W(s) = \sum_{r=0}^{\infty} w_r s^r$$

The lagged relation (iii) then reduces to the difference equation:

$$Y_t = W(E^{-1})Z_t \quad (\text{Shift Operator } EY_t = Y_{t+1}) \quad . \quad . \quad \text{(iv)}$$

If $W(s)$ is a ratio of polynomials in s, then (iv) is linear with constant coefficients.

The reduction of the lagged relation to a differential or difference equation is not difficult when the weighting function, or the set of weighting coefficients, is given empirically. If there is a finite set of w^r, then (iii) is already a difference equation. For an empirical function $w(t)$, or an infinite set of w_r, numerical methods provide $W(p)$ or $W(s)$ for use in (ii) or (iv). The following simple cases illustrate the procedure when $w(t)$ or w_r is given analytically.

Exponential Lags

The single exponential lag is defined by the relation:

$$Y(t) = \int_0^{\infty} \mu e^{-\mu\tau} Z(t-\tau)d\tau \quad (\mu > 0)$$

So: $$w(t) = \mu e^{-\mu t} \text{ and } W(p) = \frac{\mu}{p+\mu}$$

and $$Y = \frac{\mu}{D+\mu} Z \text{ or } \frac{dY}{dt} = \mu(Z - Y) \quad . \quad . \quad . \quad \text{(v)}$$

This differential equation can be checked directly from the integral for Y. The single exponential lag has one parameter μ; it is expressed by the first-order differential equation (v). Generalise by taking several such lags in succession:

$$Y = \frac{\mu_1\mu_2\mu_3 \ldots}{(D+\mu_1)(D+\mu_2)(D+\mu_3)\ldots} Z$$

This multiple exponential lag has several parameters and a differential equation of higher order than the first. Phillips (1957) shows that the response of Y to Z can be quite " realistic " when only a few terms (three or four) are taken.

Geometric Lags

The single geometric lag is defined:

$$Y_t = \sum_{r=1}^{\infty} \mu(1-\mu)^{r-1} Z_{t-r} \quad (0 < \mu \leqslant 1)$$

So: $w_r = \mu(1-\mu)^{r-1}$ for $r \geqslant 1$ and with $w_0 = 0$

and $$W(s) = \mu s \sum_{r=1}^{\infty} \{(1-\mu)s\}^{r-1} = \frac{\mu s}{1-(1-\mu)s}$$

i.e., $$W(s) = \frac{\mu}{\left(\frac{1}{s} - 1 + \mu\right)}$$

The difference equation is: $Y_t = \frac{\mu}{(E-1)+\mu} Z_t$

i.e., $$Y_t = \frac{\mu}{\Delta + \mu} Z_t \quad \text{or} \quad \Delta Y_t = \mu(Z_t - Y_t) \qquad \text{(vi)}$$

in terms of the operator $\Delta = E - 1$ ($\Delta Y_t = Y_{t+1} - Y_t$). The difference equation (vi) can be checked by writing the infinite series of the lag:

$$Y_t = \mu\{Z_{t-1} + (1-\mu)Z_{t-2} + (1-\mu)^2 Z_{t-3} + \ldots\}$$
$$Y_{t+1} = \mu\{Z_t + (1-\mu)Z_{t-1} + (1-\mu)^2 Z_{t-2} + \ldots\}$$

and then subtracting to get ΔY_t. The single geometric lag, with one parameter μ and a first-order difference equation (vi), is obviously analagous to the exponential lag (v). It can be generalised by taking several such lags in succession:

$$Y_t = \frac{\mu_1\mu_2\mu_3 \ldots}{(\Delta+\mu_1)(\Delta+\mu_2)(\Delta+\mu_3)\ldots} Z_t$$

This multiple geometric lag has several parameters and a difference equation of order higher than the first.

GROWTH MODELS, CAPITAL AND STABILITY

I. Introduction

The purpose of this paper is in part expository, in part critical. By constructing a simple model, we hope to facilitate the comparison of certain theories of economic growth which have recently been presented; by building the model around the concepts of a "natural rate of growth" and a "warranted rate of growth," we make it possible to inquire whether these theories have succeeded in refuting Sir Roy Harrod's view, first stated twenty years ago, that a growing economy is inherently unstable.[1] Before attributing significance to conclusions drawn from a model of the type here presented, however, we must first try to justify our disregard of Mrs. Robinson's insistence on the insuperable difficulty of measuring capital. We then consider in turn the neo-classical models (Solow, Swan, Tobin), finding ourselves fully in agreement with the recent paper by Professor Eisner in this Journal; the "Keynesian" model of Mr. Kaldor; and finally the work of Professor Fellner. After concluding that Harrod's problem has not been satisfactorily disposed of, we suggest briefly other uses to which our model might be put.

II. The Production Function

Underlying all the models under consideration is an aggregate production function which may be written, in its most general form, as $Q = F(K, L, t)$, expressing the dependence of total output on the amounts of capital and labour employed. The introduction of t (time) with $\frac{\partial Q}{\partial t} > 0$ implies that as time passes output will increase even if the amounts of capital and labour do not. This increase results from "technical progress," in the sense of technological advances which improve the quality of capital goods, of advances in education and training which improve the quality of the labour force, and of increasing division of labour as the market expands.[2] This function is often specialised to $Q = A(t)\, f(K, L)$, with the increase in output due to technical progress proportional to actual output, so that $\frac{A'(t)}{A(t)}$ is constant.

The factor $f(K, L)$ in the specialised form of the function is assumed to have the properties of constant returns to scale and diminishing returns to factor proportions. It follows that (assuming for the moment no technical progress) as the ratio of capital to labour increases the marginal product of

[1] R. F. Harrod, "An Essay in Dynamic Theory," Economic Journal, March 1939, pp. 14–33.

[2] A. A. Young, "Increasing Returns and Economic Progress," Economic Journal, December 1928, pp. 527–42.

capital falls and that of labour rises. A common assumption in the models considered is that these opposing changes exactly offset each other, so that the ratio of the amounts of the two factors times the ratio of their marginal products is constant: the elasticity of substitution is unity.

A form of the production function which satisfies the foregoing conditions is:

$$Q = e^{at} K^b L^{1-b} \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (1)$$
$$(a \geqq 0, 1 > b > 0)$$

This function plays a central role in Professor Swan's model [1] and an important part in that of Professor Solow.[2]

It follows from (1) that if we write G_X for $\frac{1}{X}\frac{dX}{dt}$, the rate of growth of X, $(X = Q, K, L)$, then:

$$G_Q = a + bG_K + (1 - b)G_L \quad . \quad . \quad . \quad . \quad (2)$$

From (2) it follows that:

$$G_{\frac{Q}{L}} = a + bG_{\frac{K}{L}}$$

which is the continuous form of Mr. Kaldor's " technical progress function." [3] Kaldor criticises neo-classical models for the unwarranted assumption of unit-elasticity of substitution (see below, p. 67), but it must be pointed out that this is not a crucial feature of his model, and that he draws from it no conclusions about distributive shares, as do the neo-classical writers.

As long as b remains constant, the technical progress embodied in (1) is neutral in the Hicksian sense,[4] since the factor e^{at} increases the marginal products of capital and labour in the same proportion. If we may assume that the price of capital goods in terms of consumption goods (and therefore of goods in general) is constant, the constancy of b also implies neutral technical progress in Sir Roy Harrod's sense: " I define a neutral advance as one which, at a constant rate of interest, does not disturb the value of the capital coefficient." [5] The next section will be concerned with the measurement of capital; here we shall simply assume, as we may without loss of generality, that the price of a unit of capital is unity. If we assume that entrepreneurs attempt to equate the sum of the discounted future yields of capital goods to their prices, and that these yields are expected to be constant and permanent

[1] T. W. Swan, " Economic Growth and Capital Accumulation," *Economic Record*, November 1956, pp. 334–61, especially pp. 334–8.

[2] R. M. Solow, "A Contribution to the Theory of Economic Growth," *Quarterly Journal of Economics*, February 1956, pp. 65–94, especially pp. 76–7, 85–6.

[3] N. Kaldor, "A Model of Economic Growth," ECONOMIC JOURNAL, December 1957, pp. 591–624, especially p. 604.

[4] J. R. Hicks, *The Theory of Wages* (London, 1932), pp. 121–2.

[5] R. F. Harrod, *Towards a Dynamic Economics* (London, 1948), p. 23.

(leaving questions of depreciation and obsolescence for the next section), then in equilibrium, with a rate of interest r:

$$1 = \int_0^\infty \frac{\partial Q}{\partial K} e^{-rt}\,dt = \frac{1}{r}\frac{\partial Q}{\partial K} = \frac{1}{r}\frac{bQ}{K}$$

Hence the equilibrium capital–output ratio (Harrod's C_r) is:

$$C_r = \frac{K}{Q} = \frac{b}{r} \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (3)$$

As long as b and r are constant, technical progress will not disturb the value of the capital coefficient.

III. Capital and Output

The form of equation (1) suggests that capital is to be measured in physical units, by analogy with man-hours of labour (or acres of land). The mechanics of all the theories under consideration, save that of Mr. Kaldor, require that a unit of capital shall have a constant price in terms of consumption goods, since they assume a constant or inflexible ratio of savings to income. For as Mrs. Robinson points out,[1] if the price of capital goods varies, the sacrifice of a given amount of consumption goods through saving will yield varying amounts of physical capital, so that the assumption of a constant savings ratio will imply that equation (1) ceases to hold.

In Mr. Kaldor's model the savings ratio is assumed to be flexible, but he does propose some such assumption as that capital goods are measured by the number of tons of steel embodied in them, and that the price of a ton of steel in terms of goods in general is constant.[2] Though this may, as he says, not be essential for his model, it will be argued below (p. 67) that he is safer in making some such assumption.

For all our theories except Mr. Kaldor's there is a further difficulty. If the price of capital goods in terms of consumption goods can vary, a constant rate of interest, with neutral technical progress in either the Hicks or the Harrod sense, no longer requires a constant capital–output ratio. The relationship between the rate of interest and the marginal product of capital, as analysed, for example, at the end of the preceding section, ceases to hold, and doubt is cast on the marginal productivity theory of factor rewards.[3]

Professor Swan[4] makes the "scarecrow" assumption that capital goods and consumption goods are produced by the same factors used in the same

[1] Joan Robinson, "Economic Growth and Capital Accumulation—A Comment," *Economic Record*, April 1957, pp. 103–8, especially p. 104.

[2] Kaldor, *op. cit.*, p. 599.

[3] Joan Robinson, "The Production Function and the Theory of Capital," *Review of Economic Studies*, Vol. XXI (2), 1953–4, pp. 81–106; N. Kaldor, "Alternative Theories of Distribution," *Review of Economic Studies*, Vol. XXIII (2), 1955–56, pp. 83–100, especially p. 91.

[4] Swan, *op. cit.*, p. 344.

proportions, so that their relative marginal costs, and therefore in perfect competition their relative prices, are constant. Mrs. Robinson argues [1] that as the overall capital–labour ratio increases, the rate of wages rises and the rate of profit falls, so that there are two conflicting influences on the price of capital goods, the net effect of which may be in either direction. She holds, however, that the effect must be to raise the price of capital goods if the rate of profit falls far enough.[2] But this does not meet Swan's point that it is the *relative* prices of capital goods and consumption goods that are at issue, and that: [3]

> " When wages rise and interest falls, whether the value of a ' standard axe ' goes up or down in terms of product may be expected to turn (broadly speaking) on a comparison of the relative importance of the two factors for the axe on the one hand, and for the product on the other. In general, there is no presumption either way."

In the absence of such a presumption, Swan feels justified in attaching significance to the results of a model based on his " scarecrow " assumption.

But this argument is far from disposing of Mrs. Robinson's objections. Can a unit of " physical capital " be defined? In a paper based largely on the work of Professor Leontief, Professor Solow [4] states the conditions in which the construction of an index of physical capital is possible, namely that any two pieces of capital equipment which yield equal outputs when each co-operates with one quantity of labour shall also yield equal outputs when each co-operates with any other quantity of labour. In her reply [5] Mrs. Robinson expresses less concern about the physical diversity of capital goods than about the problems of (*a*) their durability, (*b*) the effect of technical progress, both of which are neglected in Solow's analysis.

(*a*) The productivity of capital goods consists of a stream of future outputs, whose equivalent in terms of current output depends on the rate at which they are discounted. Thus two pieces of capital equipment yielding equal " outputs " at one rate of discount (and thus representing the same " quantity " of capital) may yield different " outputs " at another rate of discount. It is therefore impossible to express an old machine as the equivalent of so many new machines unless we know the rate of interest. Again the marginal productivity theory is in danger.

(*b*) If new equipment is more productive than old because of technical progress, then according to Solow's analysis it simply represents a greater quantity of capital. It becomes meaningless to speak of technical progress

[1] Joan Robinson, " Economic Growth and Capital Accumulation—A Comment," p. 107.
[2] *Ibid. The Accumulation of Capital* (London, 1956), p. 406.
[3] Swan, *op. cit.*, p. 360.
[4] R. M. Solow, " The Production Function and the Theory of Capital," *Review of Economic Studies*, Vol. XXIII (2), 1955–56, pp. 101–8.
[5] Joan Robinson, " The Production Function and the Theory of Capital—A Reply," *Review of Economic Studies*, Vol. XXIII (3), 1955–56, p. 247.

as raising the productivity of a given quantity of capital. In his interesting attempt to measure the actual rate of technical progress [1] he is, of course, forced to abandon his definition of a unit of capital by reference to its productivity.

As to (*a*), Swan's "scarecrow" assumption is that capital goods last for ever with unimpaired efficiency.[2] We would propose a compromise between this and the assumption of Professors Champernowne and Kahn,[3] which is that machines operate at constant efficiency for T years and then fall to pieces. We assume with Swan that capital goods last for ever (unless their scrap value comes to exceed their value in production) but that their efficiency declines exponentially, so that a piece of equipment of age t is the equivalent in production of e^{-at} pieces of new equipment; this ratio is, of course, independent of the rate of interest.

As to (*b*), Swan assumes [4] that technical progress does not alter the physical form of capital goods, but only the methods whereby they are combined with labour in production. We are reluctant to dismiss the problem of obsolescence so readily. But in what sense can we speak of a "given quantity" of capital when technical progress alters the form of capital goods? Our only recourse is to some such assumption as Kaldor's mentioned above (p. 59), so that the price of capital goods in terms of consumption goods is constant, and equation (1) continues to hold for capital so measured. Owing to technical progress, represented by e^{at}, a piece of capital equipment which cost as much as a unit of consumption goods when it was produced t years ago would be the equivalent in production (if no physical deterioration had taken place) of e^{-at} pieces of new equipment, where a piece of new equipment currently costs as much as a unit of consumption goods.

The joint effect of these two assumptions is that, through physical deterioration and obsolescence, a piece of equipment which was a unit of capital when it was new t periods ago is now the equivalent of only $e^{-(a+a)t}$ units. Such a formula may perhaps find some justification in the practice, very common in the United Kingdom though less so in the United States, of charging depreciation by the "percentage of diminishing balance" method.

The argument of this section, however, requires us to reconsider the variable Q in equation (1), which is normally taken to represent net output. In our case, the difference between gross and net output is a constant fraction of the stock of capital. It follows that in general the functions relating gross and net output to the amounts of capital and labour employed cannot both

[1] R. M. Solow, "Technical Change and the Aggregate Production Function," *Review of Economics and Statistics*, August 1957, pp. 312–20.

[2] Swan, *op. cit.*, p. 344.

[3] D. G. Champernowne and R. F. Kahn, "The Value of Invested Capital," *Review of Economic Studies*, Vol. XXI (2), 1953–54, pp. 107–11; reprinted as an Appendix to Joan Robinson's *The Accumulation of Capital*, pp. 429–35.

[4] Swan, *op. cit.*, p. 344.

be subject to constant returns to scale.[1] It seems more reasonable to assume this property to be enjoyed by the gross output function; accordingly, Q will henceforth stand for gross output. The argument at the end of the preceding section must be modified as follows:

$$1 = \int_0^\infty \frac{\partial Q}{\partial K} e^{-(r+u+a)t}\, dt = \frac{1}{r+u+a}\,\frac{bQ}{K}$$

$$C_r = \frac{K}{Q} = \frac{b}{r+u+a} \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (3')$$

IV. The Natural Rate of Growth

The "natural rate of growth," G_n, plays an important part in Sir Roy Harrod's analysis; it is "the rate of advance which the increase of population and technological improvement allow" and "represents the line of output at which producers of all kinds will be satisfied that they are making a correct balance between work and leisure; it excludes the possibility of 'involuntary' unemployment."[2] It follows from (2) that the rate of growth of output is not completely determined when the rate of technical progress, the rate of growth of the labour supply and the condition of full employment are given. G_Q depends also on the rate of growth of capital, and both Professor Swan[3] and Mr. Kaldor[4] speak of a variety of natural rates of growth even when a, b and G_L are given. Harrod has stated[5] that his G_n does not depend on the rate of growth of capital; on the contrary, it requires a certain rate of growth of capital. This can only be a rate equal to the rate of growth of output. For if this were not so, a situation in which the warranted rate of growth, which requires a constant capital–output ratio so that $G_Q = G_K$, is equal to the natural rate would be not only unstable but impossible. We conclude that, from (2):

$$G_n = a + bG_n + (1-b)G_L = \frac{a}{1-b} + G_L \quad . \quad . \quad (4)$$

This is the equilibrium rate of growth of both output and capital in Swan's and Kaldor's models.[6] In the next two sections we consider their arguments in turn.

[1] Constant returns to scale in one function imply constant returns to scale in the other if, and only if, the ratio of capital to output is constant. This is in fact an equilibrium condition in our models, but must not be assumed at this stage.

[2] Harrod, *op. cit.*, p. 87.

[3] Swan, *op. cit.*, p. 342.

[4] Kaldor, "A Model of Economic Growth," p. 612.

[5] In a letter to the author.

[6] And would be so also, were it not for an algebraic slip, in Professor Solow's model; *cf.* "A Contribution to the Theory of Economic Growth," pp. 85–6.

V. The Neo-classical Model

In the neo-classical models of Professors Solow and Swan, the required capital–output ratio is determined as described at the end of Sections (II) and (III) above (equations (3) and (3′)), and the ratio of savings to output, s, is assumed constant. Hence:

$$G_w = \frac{s}{C_r} = \frac{s(r+u+a)}{b} \quad . \quad . \quad . \quad . \quad . \quad (5)$$

G_w is Harrod's " warranted rate of growth "; " G_w is the entrepreneurial equilibrium; it is the line of advance, which, if achieved, will satisfy profit takers that they have done the right thing." [1] If $G_w < G_Q$, then:

$$C_r > \frac{s}{G_Q} = \frac{dK}{Q} \div \frac{dQ}{Q} = \frac{dK}{dQ}$$

so that the required capital–output ratio exceeds the actual incremental capital–output ratio. Provided that the existing capital–output ratio K/Q does not exceed C_r, this will stimulate investment; at the existing market rate of interest planned investment (to use Professor Fellner's terminology) will exceed actual saving. On the neo-classical view, this will drive up the market rate of interest. If $G_w > G_Q$ the actual incremental capital–output ratio will exceed C_r. Provided that the existing capital–output ratio K/Q is not less than C_r, investment will be discouraged and the market rate of interest will fall.

Professor Swan assumes that if $G_w < G_n$, there is full employment so that $G_w < G_n = G_Q$. The market rate of interest therefore rises and, since in the neo-classical models r in (5) is equated with the market rate of interest, G_w also rises. If $G_w > G_n$, G_w must exceed G_Q (which cannot for long exceed G_n), and the market rate of interest will fall, as will G_w.

The attainment of equilibrium with $G_Q = G_w = G_n$, and its stability when attained, depend on the possibility of changing r, and the responsiveness of C_r to changes in r. We follow Harrod in doubting the efficacy of the market rate of interest in this context.[2] In the first place, the market rate of interest may itself have an irreducible minimum. Secondly, the r which appears in equation (5) is the rate at which entrepreneurs discount future yields, an " internal rate of return " whose connection with the market rate of interest is extremely tenuous. Finally, we note that Solow claimed as a weakness of Harrod's model the " crucial " assumption of fixed technical coefficients. Professor Eisner points out [3] that this is misleading; the true issue between Harrod and Solow turns on the effectiveness of the rate of

[1] Harrod, *op. cit.*, p. 87.

[2] *Ibid.*, Lecture Five.

[3] Robert Eisner, " On Growth Models and the Neo-classical Resurgence," Economic Journal, December 1958, pp. 707–21, especially pp. 713–14.

interest, and there is in Solow's model the " crucial " assumption that the marginal product of capital is always positive. If this crucial assumption (which is implicit in our own equation (1)) is not made, the " internal rate of return " may fall to zero without bringing about equilibrium. Moreover, to regard the entrepreneur as so easily encouraged or discouraged by changes in the market rate of interest is to belittle unduly his role in the economic process, as Mr. Kaldor would no doubt agree.[1]

A further source of stability may be sought in monetary factors. (The following analysis owes much to Professors Tobin [2] and Eisner.[3]) Let us assume that the desire to save can be satisfied either by accumulating claims to physical capital or by adding to the real value of the stock of " money "; " money " here includes, roughly speaking, currency plus government debt, but not commercial bank deposits.[4] We continue to assume that real saving is a constant fraction of real income (we could add increases in the real value of the stock of " money " to real income as a determinant of saving without affecting the argument essentially). Writing M for the nominal quantity of " money " and p for the price level, we have:

$$\frac{dK}{dt} + \frac{d}{dt}\left(\frac{M}{p}\right) = sQ$$

The savings implicit in the expression for G_w (equation (5) above) are those which it is desired to hold in the form of claims to physical capital. Thus

$$\frac{1}{Q}\frac{dK}{dt} = s - \frac{1}{Q}\frac{d}{dt}\left(\frac{M}{p}\right)$$

and (5) becomes:

$$G_w = \frac{r+u+a}{b}\left[s - \frac{1}{Q}\frac{d}{dt}\left(\frac{M}{p}\right)\right] \quad . \quad . \quad . \quad . \quad (5')$$

If the equality of G_w and G_n is sought through changes in p alone, with M held constant, then $\frac{d}{dt}\left(\frac{M}{p}\right) = -\frac{M}{p}G_p$, and (5') becomes

$$G_w = \frac{r+u+a}{b}\left(s + \frac{M}{pQ}G_p\right)$$

It appears that falling prices ($G_p < 0$) will reduce G_w by reducing the effective savings ratio. But the expectation of falling prices will cause the expected real rate of interest to stand above the money rate.[5] Just as our

[1] N. Kaldor, " The Relation of Economic Growth and Cyclical Fluctuations," ECONOMIC JOURNAL, March 1954, pp. 53–71, especially pp. 69–71.

[2] James Tobin, "A Dynamic Aggregative Model," *Journal of Political Economy*, April 1955, pp. 103–15.

[3] Eisner, *op. cit.*

[4] Cf. Tobin, *op. cit.*, p. 105, and the references there cited.

[5] W. Fellner, *Trends and Cycles in Economic Activity* (New York, 1956), pp. 171–3; Eisner, *op. cit.*, p. 720; Solow, "A Contribution to the Theory of Economic Growth," p. 80.

discussion of Solow's model was not meant to deny that there is always some real rate of interest (which might have to be negative), derived from the market rate and the rate of change of the price level,[1] that would be low enough to encourage investment sufficiently, so it cannot be denied that there is always some real rate of interest high enough to discourage it. Thus falling prices will reduce the effective savings ratio, but may well also reduce C_r, so that the net effect on G_w is not certain. (Of course, this solution may in any case require a degree of money-wage flexibility which is institutionally unattainable.)

If the price level is held constant and M is increased C_r will be unaffected. Harrod himself proposes a scheme whereby price stability and full employment could be simultaneously maintained by buffer stocks and budget deficits.[2] But this is a far cry from the self-regulating classical mechanism.

VI. A "Keynesian" Model

In Mr. Kaldor's view it is the ratio of savings to income, rather than the required capital–output ratio, that bears the burden of adjustment. Investment is the independent and saving the dependent variable; it is in this way that he justifies the use of the term "Keynesian," [3] although here it is the distribution of income rather than its level that changes in order to bring about the equality of saving and planned investment. The mechanism is as follows: [4]

Given full employment—

> "a rise in investment, and thus in total demand, will raise prices and profit margins, and thus reduce real consumption, whilst a fall in investment, and thus in total demand, causes a fall in prices (relatively to the wage level) and thereby generates a corresponding rise in real consumption. Assuming flexible prices (or rather flexible profit margins) the system is thus stable at full employment.
>
> "The model operates only if the two savings propensities differ and the marginal propensity to save from profits exceeds that from wages, *i.e.* if:
>
> $$s_p \neq s_w \quad \text{and} \quad s_p > s_w$$
>
> "The latter is the stability condition. For if $s_p < s_w$, a fall in prices would cause a fall in demand and thus generate a further fall in prices, and equally, a rise in prices would be cumulative."

[1] Let r_r be the real rate of interest, r_m the money rate of interest (both compounded continuously), and G_p the proportional change in the price level, $\frac{1}{p}\frac{dp}{dt}$. Then as Professor Solow shows: $r_r = r_m - G_p$.

[2] Harrod, *op. cit.*, pp. 134 ff.

[3] N. Kaldor, "Alternative Theories of Distribution," pp. 94–5; "A Model of Economic Growth," pp. 594–5.

[4] "Alternative Theories of Distribution," p. 95.

He also assumes [1] "an investment function which makes investment in any period partly a function of the change in output in the previous period and partly of the change in the rate of profit on capital in that period." This implies, for example, $K = cQ + f\frac{P}{K}$, where P is total profit.[2] The way in which profit is introduced into this function is, as Kaldor admits, to some extent arbitrary; and this particular function is somewhat awkward to handle. In an exposition of the mechanics of his model, and for our present critical purpose, little is lost if we simplify by assuming the level of output to be the sole determinant of the required stock of capital, so that $C_r = \frac{K}{Q} = \bar{c}$.[3]

Hence in Kaldor's model (we write W for total wages):

$$s = s_p\frac{P}{Q} + s_w\frac{W}{Q} = s_p\frac{P}{Q} + s_w\left(1 - \frac{P}{Q}\right) = (s_p - s_w)\frac{P}{Q} + s_w \quad (6)$$

$$G_w = \frac{s}{C_r} = \frac{(s_p - s_w)\frac{P}{Q} + s_w}{\bar{c}} \quad . \quad . \quad . \quad . \quad . \quad (7)$$

If $G_w < G_n$ and there is full employment the capital stock is deficient and investment is encouraged. The resulting increase in $\frac{I}{Q}$ increases $\frac{P}{Q}$, and by (6) and (7) s and G_w are raised. If $G_w > G_n$, investment is discouraged, and $\frac{P}{Q}$, s and G_w are lowered.

Kaldor concedes that his model will not bring about the equality of G_w and G_n needed for equilibrium if the shares of wages and profits are inflexible.[4] He speaks of a lower limit to $\frac{P}{Q}$ as being set by an "acceptable" rate of profit on turnover, below which entrepreneurs will not lower prices. He speaks only of the subsistence level of wages as setting a lower limit to $\frac{W}{Q}$. Such an assumption is incomplete nowadays; an attempt to lower real wages below a level substantially in excess of biological subsistence will lead to resistance (*cf.* the "inflation barrier" of Mrs. Robinson [5] and Professor Champernowne [6]). What evidence is there that the flexibility of distributive shares can be relied upon with any more confidence than the market rate of

[1] "A Model of Economic Growth," p. 601.

[2] *Op. cit.*, p. 604, equation (2).

[3] Kaldor shows that, in his model, the economy will reach a stable equilibrium with the growth rate of capital equal to that of output, and adds: "The indirect effects through changes in the rate of profit on capital will reinforce this process" (*op. cit.*, p. 610).

[4] *Op. cit.*, pp. 607–9.

[5] Joan Robinson, *The Accumulation of Capital*, p. 48.

[6] D. G. Champernowne, "Capital Accumulation and the Maintenance of Full Employment," ECONOMIC JOURNAL, June 1958, pp. 211–44, especially p. 224.

interest to bring about equilibrium? And if it is agreed that a significant degree of inflexibility exists, we still need to know why distributive shares are limited to a certain range of values: we still need a theory of distribution.

Mrs. Robinson's own view is that Harrod's instability will be avoided by changes both in s (through the Kaldor mechanism) and in C_r (through appropriate changes in the relative prices of capital goods and consumption goods).[1] There would appear to be no reason, in view of Swan's argument quoted above (p. 60), to expect the prices of capital goods to move in the required direction rather than the opposite. In Kaldor's model (depending on how we choose to measure capital goods when their prices change) this might alter s or C_r in a way which would prevent the attainment of equilibrium; it is for this reason that we suggested above (p. 59) that he was safer with his " steel " assumption than without it.

Kaldor is concerned to " explain " certain observed historical constancies in the United States and the United Kingdom, in particular those of the capital–output ratio, the share of profits in income and the rate of profit. He says: [2]

> " Existing theories are unable to account for such constancies except in terms of particular hypotheses (unsupported by any independent evidence), such as the unity-elasticity of substitution between Capital and Labour, or more recently, constancy of the degree of monopoly or the ' neutrality ' of technical progress. One of the merits of the present model is that it shows that the constancy in the capital/output ratio, in the share of profit and in the rate of profit can be shown to be the consequence of endogenous forces operating in the system."

We submit that the constancy of these ratios depends on the constancy of the parameters of his equations, as well as on the mechanism of his model. By what " independent evidence " is the stationariness of his savings function, his investment function and his " technical progress " function supported? In this respect the observed historical constancies can by no means be held to be more satisfactorily accounted for by Kaldor's model than by the neo-classical model. The Joan Robinson–Kaldor savings function (6), however, is an innovation which could well be introduced into the neo-classical model, though of course as long as distributive shares are assumed to remain unchanged, (6) implies that the ratio of savings to income remains constant.

VII. The Role of Technical Progress

Both the neo-classical and the " Keynesian " models examined have been found to be internally consistent, to yield the same stable equilibrium rate of growth and the constancy of certain ratios which have been observed to

[1] Joan Robinson, *op. cit.*, pp. 404–6.
[2] Kaldor, *op. cit.*, pp. 592–3.

be constant. With great respect to Mr. Kaldor, we are still inclined to regard the marginal productivity theory as the best theory of distribution we have. We are not unduly disturbed by the assumptions we found it necessary to make in order to justify it (Section III above), and indeed we have suggested (p. 67 above) that Mr. Kaldor's own model might not work unless he made similar assumptions. In default of evidence that distributive shares are as responsive to his mechanism as he claims, we are reluctant to abandon the " principle of substitution " as it relates to capital and labour, and shall continue to assume that the shares of profits and wages in output are b and $(1 - b)$ respectively. Incorporating the savings function (6) in (5), we have:

$$G_w = \frac{s(r + u + a)}{b} = (r + u + a)\left[s_p + s_w\left(\frac{1}{b} - 1\right)\right] \quad . \quad (8)$$

Given a, b, s_p, s_w and u, the value of r necessary for equilibrium can be obtained by setting $G_w = G_n$. We shall assume, in the spirit of Sir Roy Harrod's Lecture Five, that r remains constant (though not necessarily at the equilibrium level). We are assuming, in effect, that the net " internal rate of return " remains unchanged during periods of temporary or chronic disequilibrium. Equation (8), together with the assumption that r is constant, expresses our view that Harrod's problem has not been disposed of by the theories so far discussed.

How else might the equality of G_w and G_n be brought about? We shall consider, since this has received most attention, only the case where $G_w > G_n$, but what we shall say will apply, *mutatis mutandis*, to the reverse case. A reduction in s_p or s_w will reduce G_w and so lead towards equilibrium. The possibility that the effective savings ratio might be reduced through the operation of monetary factors was discussed at the end of Section V above. A reduction in u, increasing the " half-life " of equipment, will reduce G_w by increasing C_r, for since yields will fall off less rapidly, equipment of smaller current yield, and therefore a higher capital–output ratio, will be acceptable.

The " technical progress " parameters a and b are perhaps the most interesting and powerful possible source of relief from secular stagnation. Assuming G_L to be constant, we have, from (4) and (8):

$$\frac{\partial}{\partial a}(G_w - G_n) = s_p + s_w\left(\frac{1}{b} - 1\right) - \frac{1}{1 - b} \quad . \quad . \quad . \quad (9)$$

An increase in a will clearly increase G_n. It will also increase G_w, since with more rapid obsolescence higher current yields will be required, necessitating a smaller capital–output ratio C_r. But if we take $\frac{1}{3}$ or $\frac{1}{4}$ as alternative plausible values for b, (9) becomes $s_p + 2s_w - \frac{3}{2}$ or $s_p + 3s_w - \frac{4}{3}$ respectively, which will almost certainly be negative, since s_w may be taken to be small. Hence a greater overall rate of technical progress will very probably reduce the excess of G_w over G_n.

If b increases, technical progress will raise the marginal product of capital in a greater proportion than the marginal product of labour, and will become " labour-saving " or " capital-using." From (4) and (8):

$$\frac{\partial}{\partial b}(G_w - G_n) = -(r + a + u)\frac{s_w}{b^2} - \frac{a}{(1-b)^2} \quad . \quad (10)$$

An increase in b will increase G_n; it will also reduce G_w by increasing C_r in greater proportion than s. (An increase in b increases s because, in our model, it increases the share of profits in output.) Labour-saving innovations can therefore avert secular stagnation.

The foregoing analysis is consistent with that of Professor Fellner.[1] Harrod's disagreement with Fellner [2] concerns what happens if the effect of an increase in b is to raise G_n above G_w, and if the marginal productivity of labour is affected in such a way as to cause the supply of labour to exceed the demand at the existing real wage-rate. Clearly there must be either unemployment or a reduction in real wages brought about, probably, by inflation. Fellner stresses the former alternative, Harrod the latter.

Professor Eisner rules out the " employment of capital-using innovations like a *Deus ex machina* to set the plot straight." [3] The term is apt. For if technical progress is to be regarded as a stabilising force it must be shown that there is reason to believe that innovations of the required intensity and bias will appear when they are needed. Professor Hicks's argument that [4] " a change in the relative prices of factors is itself a spur to invention . . . directed to economizing the use of a factor which has become relatively expensive " is answered by Fellner when he says: [5]

> " There exists no good reason for believing that a purely competitive buyer will notice *direct indications* of the labour scarcity, which in the interest of the growth process should induce him to seek improvements that shift up primarily the marginal productivity of the existing *capital stock*. The purely competitive firm can hire any amount of additional labour at the going wage rate . . . [it] will initially believe that its profits will increase in the same proportion with the ' wrong ' as with the ' right ' kind of improvement."

Fellner believes that nonetheless such a mechanism exists, but his argument is very compressed, and his claim that entrepreneurs would spontaneously interpret their collective experience in such a way that they would be led to introduce the " right " kind of improvement [6] carries little conviction as

[1] Fellner, *op. cit.*, pp. 209 ff.

[2] R. F. Harrod, " Professor Fellner on Growth and Unemployment," *Kyklos*, Fasc. 1, 1957, pp. 1–17, especially pp. 5 ff.

[3] Eisner, *op. cit.*, p. 720.

[4] Hicks, *The Theory of Wages*, p. 124.

[5] Fellner, *op. cit.*, pp. 220–1.

[6] *Loc. cit.*

it stands. In any case, the situation in which labour-saving inventions would be needed is one in which $G_w > G_n$, so that unless the induced improvement mechanism worked very rapidly the economy would be depressed, and the labour scarcity which would exist if there were full employment would not be apparent. It would be of great interest if Professor Fellner would elaborate upon his "mechanism of induced improvements," since this is a major possible source of stability which has not yet been systematically explored.

A point which emerges from our analysis is that an excess of G_w over G_n can very probably be eliminated by a sufficient increase in a, the overall rate of technical progress, without any need for a change in b (see equation (9) above and the subsequent discussion). Changes in a, however, as distinct from b, could scarcely be explained on economic grounds alone; it is only within a broader model, perhaps of the type outlined by Professor Rostow [1] and stressing the role of the entrepreneur as did Mr. Kaldor in 1954,[2] that a could be made to change automatically.[3]

VIII. A Diagrammatic Summary

It may be useful, by way of summary, to present a geometric comparison of the main "solutions" to Sir Roy Harrod's problem that have been discussed in this paper. For this purpose, we make use of the very ingenious diagram devised by Professor Swan.[4] In this diagram the rates of growth of output, capital and labour are measured vertically, and on the horizontal axis is measured $\frac{Q}{K}$, the ratio of output to capital.

Let s be the ratio of investment, $\frac{dK}{dt}$, to output, Q. Then $\frac{dK}{dt} = sQ$ and

$$G_K = \frac{1}{K}\frac{dK}{dt} = s\frac{Q}{K}$$

From our equation (2) above, (p. 58):

$$G_Q = a + bG_K + (1 - b)G_L$$

$$= a + (1 - b)G_L + bs\frac{Q}{K}$$

The functions relating G_K and G_Q to $\frac{Q}{K}$ are represented by solid straight

[1] W. W. Rostow, *The Process of Economic Growth* (New York, 1952).

[2] N. Kaldor, "The Relation of Economic Growth and Cyclical Fluctuations."

[3] Professor Champernowne (*op. cit.*, p. 216) defines the rate of technical progress in such a way that it would correspond, in our model, to $\frac{a}{1-b}$. If G_L were zero, $\frac{a}{1-b}$ would be the equilibrium rate of growth in our model, but we prefer to regard this as the result of capital accumulation as well as of technical progress, as does Professor Swan (*op. cit.*, p. 337).

[4] *Op. cit.*, p. 336.

lines in the diagram. The line representing G_Q has a positive intercept, $a + (1 - b)G_L$, on the vertical axis, and since $b < 1$, its slope is less than that of the G_K line. The natural rate of growth, at which $G_Q = G_K$ (see Section IV above) is represented by the horizontal straight line G_n passing

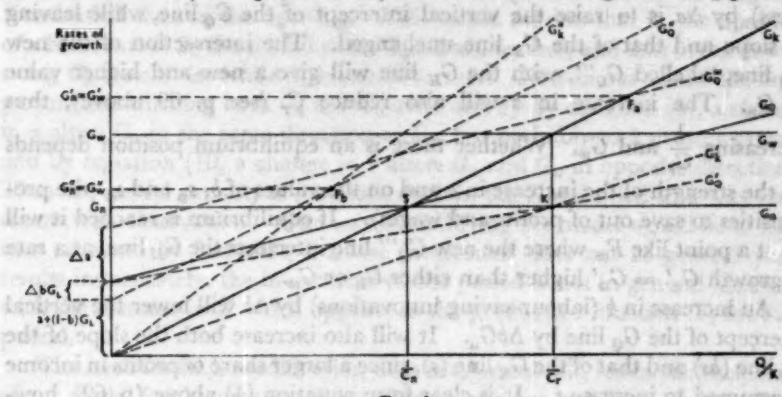

FIG. 1

through the intersection of the G_Q and G_K lines. Let us call C_n the capital–output ratio associated with G_n; the corresponding ratio of output to capital is labelled $\frac{1}{C_n}$ in the diagram.

Harrod's problem is that the required capital–output ratio C_r may differ from C_n. The case illustrated in the diagram is that in which C_r is less than C_n, so that $\frac{1}{C_r} > \frac{1}{C_n}$. The warranted rate of growth $G_w = \frac{s}{C_r}$ is then the height of the G_K line when $\frac{Q}{K}$ has the value $\frac{1}{C_r}$.[1] G_w is represented by a horizontal line in the diagram. Since $C_r < C_n$, it follows that $G_w > G_n$.

On the neo-classical view (see Section V above) it is C_r that adjusts itself by increasing to C_n, so that $\frac{1}{C_r}$ falls to $\frac{1}{C_n}$ and G_w falls to G_n. Equilibrium is at the point S, and is stable, for if G_Q exceeds G_K, $\frac{Q}{K}$ rises, and if G_K exceeds G_Q, $\frac{Q}{K}$ falls, so that in either case the system returns to S.

According to our interpretation of the neo-Keynesian model (see Section VI above), equilibrium comes about through a reduction in s. The G_Q and G_K lines become flatter, eventually becoming G_Q' and G_K', and intersecting at K. Again G_w falls to G_n. As Professor Swan points out,[2] and as is apparent from our own equation (4) (p. 62 above), the equilibrium or natural

[1] This is because the G_K line passes through the origin with slope s, and $s \times \frac{1}{C_r} = \frac{s}{C_r}$.

[2] *Op. cit.*, pp. 337–8.

rate of growth, at which the G_Q and G_K lines intersect, will not be affected by a change in s alone; G_n depends only on the values of a, b and G_L.

As to the argument based on Professor Fellner's work (see Section VII above), the effect of an increase in a (the overall rate of technical progress) by Δa is to raise the vertical intercept of the G_Q line, while leaving its slope and that of the G_K line unchanged. The intersection of the new G_Q line, labelled G_Q''', with the G_K line will give a new and higher value of G_n. The increase in a will also reduce C_r (see p. 69 above), thus increasing $\frac{1}{C_r}$ and G_w. Whether there is an equilibrium position depends on the strength of the increase in a and on the values of b, s_p and s_w (the propensities to save out of profits and wages). If equilibrium is reached it will be at a point like F_a, where the new G_Q''' line intersects the G_K line, at a rate of growth $G_n' = G_w'$ higher than either G_n or G_w.

An increase in b (labour-saving innovations) by Δb will lower the vertical intercept of the G_Q line by $\Delta b G_L$. It will also increase both the slope of the G_Q line (bs) and that of the G_K line (s), since a larger share of profits in income is assumed to increase s. It is clear from equation (4) above (p. 62), however, that an increase in b alone must increase G_n, so that the new lines G_Q'' and G_K'' must intersect above the line G_n. C_r will be increased (see p. 69 above) and $\frac{1}{C_r}$ and G_w will be reduced. If the increase in b is strong enough there will be an equilibrium point F_b, at a rate of growth G_n'' and G_w'' between G_w and G_n.[1]

IX. Trend and Cycle

The model summarised by equations (4) and (8) is offered as a useful framework within which to study economic growth and its stability. It seems likely that over the past 150 years the parameters have been, on balance, such as to maintain equilibrium. In default of a convincing account of a mechanism which has maintained this equilibrium, however, we are inclined to re-emphasise the independence of G_w from G_n, and to question the stability of the system.

Is our model able to interpret other phenomena, apart from the "historical constancies" discussed at the end of Section VI above? Mr. Kaldor's "two stages of capitalism" [2] are not very well established statistically; it appears that real wages did rise in the first half of the nineteenth century, if somewhat less rapidly than later.[3] The difference could as well be explained, however, by an increase in b in our model (labour-saving innovations) in the early period as by Kaldor's mechanism.

[1] It can also be verified algebraically that the new capital-output ratio must, as in the diagram, be greater than either C_r or C_n.

[2] N. Kaldor, "A Model of Economic Growth," pp. 618–21.

[3] W. W. Rostow, *British Economy of the Nineteenth Century* (Oxford, 1948), Chapter 1.

What of the Kondratieff? Sir Roy Harrod has recently suggested [1] that the upswing and downswing of the Kondratieff can be explained in terms of an excess of G_n over G_w and of G_w over G_n respectively. It seems to be agreed, however,[2] that output increases more rapidly in the downswing of a Kondratieff than in the upswing. This would require that in the upswing of a Kondratieff G_n should fall while G_w fell still further, and that in the downswing G_n should rise while G_w rose still further. Now in our model the only parameters affecting both G_n and G_w are a and b; by equation (9), a change in a alters G_n in the same direction as G_w, but probably to a greater extent, and by equation (10) a change in b alters G_n and G_w in opposite directions. Thus our model cannot, as it stands, explain the Kondratieff in a way consistent with observation. One way of modifying the model would be to take into account the fact that, because investment does not in general yield results immediately, the investment of one period is not in general identical with the increase in K which appears in the production function (1) for that period.

The need for such modification does not, we submit, lessen the usefulness of our model for the purpose of considering long-run stability. A promising approach to the Kondratieff might be to show the consequences of fluctuations in b about some " normal " level b_0; but it would be the normal level b_0 itself, in conjunction with the other parameters of the system, that would determine its long-run stability or instability.

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[1] Harrod, " Professor Fellner on Growth and Unemployment," p. 3.

[2] Rostow, *loc. cit.*; J. A. Schumpeter, *Business Cycles* (New York, 1939), p. 504.

NOTES ON SOME CONTROVERSIES IN THE THEORY OF INTERNATIONAL TRADE

IT is proposed in this paper to review four disputed problems in the theory of international trade.

(1) The first problem concerns the impact of an autonomous shift in international demand on the net barter terms of trade and the volume of trade. Graham disputed the solution that Marshall offered to this problem in *Money, Credit and Commerce*. The contradiction between their rival solutions stems from alternative meanings attached to the "increase" in demand; this is seen to emerge readily from an extension of recent developments of demand theory.

(2) The second problem concerns Edgeworth's proposition that a reduction in the cost of production of exportables in a country may lead to her impoverishment. Nicholson disputed this proposition on the ground, among others, that the model used to demonstrate the result was very restrictive. It is shown that this possibility, and the conditions under which it will obtain, can be established for less restrictive models.

(3) The third problem relates to Marshall's measure of the "net benefit" from foreign trade and Viner's objection to it. These rival measures are here evaluated with the aid of an extension of modern welfare economics to the theory of international trade.

(4) The fourth problem relates to Marshall's theorem that, where international demands are sufficiently inelastic for international equilibrium to be unstable, there exists at least one position of stable equilibrium on each side of the unstable equilibrium point.

I. MARSHALL *vs.* GRAHAM ON CHANGES IN INTERNATIONAL DEMAND, TERMS OF TRADE AND VOLUME OF TRADE

In Chapter VIII of *Money, Credit and Commerce* Marshall discusses the problem of how far the terms of trade and the volume of trade would be changed if "trade between two countries E and G having been in equilibrium, there is a considerable increase in E's demand for G's goods, unaccompanied by any corresponding increase of demand on the part of G." [1] His solution, lucidly set out in Appendix J, is that the extent of the deterioration in E's terms of trade will vary directly with E's elasticity of demand for imports and inversely with G's elasticity of demand for imports; and the magnitude of the increase in the volume of trade will vary directly with *both* these elasticities.[2]

[1] Marshall, *Money, Credit and Commerce* (Macmillan, 1923), p. 177.
[2] *Ibid.*, p. 178.

Graham, on the other hand, has argued that deterioration in E's terms of trade will vary inversely with *both* these elasticities while the extent of the increase in the volume of trade will vary inversely with E's elasticity and directly with G's elasticity.[1]

A. Graham's Solution

In the following analysis we shall use the two-country (E and G), two-commodity (E-goods and G-goods) " real " model which both Marshall and Graham were using.

Starting from a position of balanced trade, assume that E's demand for G's goods has increased in the sense that, at each level of the terms of trade, the quantity of imports demanded by E from G has increased in a given proportion; this increase can be represented by an increase in the quantity of imports demanded by E at the initial terms of trade. What will be the resultant impact on the international commodity terms of trade?

Assuming that the terms of trade have been readjusted so as to restore equilibrium in trade, we can analyse the change in the quantity of G-goods imported into E into two components:

(i) The postulated increase in the quantity of G's goods demanded at the initial terms of trade: it may be denoted by $\overline{dM}$, where M refers to E's initial quantity of imports of G's goods.

(ii) The decrease in the quantity of G's goods demanded as the terms of trade move in favour of G-goods to restore equilibrium: this is measured by $M \,.\, \alpha \,.\, dp$, where $\alpha = -\frac{p}{M} \cdot \frac{dM}{dp}$ is the elasticity of E's demand for imports, and p is the terms of trade, measured as the price of G-goods divided by the price of E-goods and assumed by choice of units to be unity initially.

The total change in the quantity of G-goods imported into E may thus be measured by:

$$(1) \qquad \overline{dM} - M \,.\, \alpha \,.\, dp$$

[1] Graham, " The Theory of International Values," *Quarterly Journal of Economics*, Vol. 46, 1932, pp. 601–2. Viner supports Graham's position in his *Studies in the Theory of International Trade* (Harper & Bros., N.Y., 1937), pp. 543–6. In analysing the Marshall–Graham controversy Viner discards the use of offer curves in favour of diagrams with E-bales on the X-axis and the terms of trade (G-bales per E-bale) on the Y-axis, which leads him easily into construing " shift in demand " in the traditional, and as we shall see Graham's, sense of change in the quantity of E-bales demanded by G from E at given terms of trade. It should also be mentioned that alternative solutions of the Marshall–Graham controversy are to be found in Allen, " The Effects on Trade of Shifting Reciprocal Demand Schedules," *American Economic Review*, Vol. 42, 1952, pp. 135–40; and Kemp, " The Relation between Changes in International Demand and the Terms of Trade," *Econometrica*, Vol. 24, 1956, pp. 41–6. As contrasted with these solutions, however, our approach combines simplicity with the explicit demonstration of the significance of stability conditions, further enabling us to attack directly the Edgeworth–Nicholson controversy in Section II; we further link the problem to the general theory of value.

But it can also be measured in terms of the change in the quantity of G-goods supplied by G:

$$M \cdot r_m \cdot dp \tag{2}$$

where $r_m = \frac{p}{M} \cdot \frac{dSm}{dp}$ ($Sm \equiv M$ initially) is the elasticity of G's supply of G-goods to E. In equilibrium, (1) = (2). Solving for dp, therefore, we get:

$$dp = \frac{\overline{dM}}{M(r_m + \alpha)} \tag{3}$$

However, both Marshall and Graham couch their argument, as we have seen, in terms of G's elasticity of demand for E's goods instead of in terms of G's elasticity of supply of her goods to E as we have done. We must, therefore, recast formula (3) accordingly. Let us define G's elasticity of demand for imports of E's goods as $\eta_x = \frac{p}{X} \cdot \frac{dX}{dp}$, where X is the initial quantity of E-goods imported by G. Then, by a well-known proposition, $\eta_x - r_m = 1$. Formula (3) thus becomes:

$$dp = \frac{\overline{dM}}{M(\eta_x + \alpha - 1)} \tag{4}$$

Concerning the change in the terms of trade, therefore, we have emerged with Graham's solution: if we confine ourselves to stable situations ($\eta_x + \alpha - 1 > 0$) the extent to which the terms of trade will become unfavourable to E varies inversely with the elasticities of *both* G and E. It may also be noticed that, provided the stability condition is fulfilled, this conclusion holds even when G's elasticity is less than unity.[1]

The change in the volume of trade is also in conformity with Graham's findings, and can be obtained readily as:

$$M \cdot r_m \cdot dp = \frac{(\eta_x - 1)\overline{dM}}{(\eta_x + \alpha - 1)} \tag{5}$$

For elastic G-demand ($\eta_x > 1$), therefore, the increase in the volume of trade will be greater, the smaller is E's elasticity of demand for imports and the larger is G's elasticity, provided the stability condition is satisfied.

B. *Marshall's Solution*

It seems surprising that Marshall should, however, have reached a different result. But the puzzle is readily solved when we find that Marshall is construing the increase in E's demand for G's goods to mean that "the number OM' of her bales, which she will [now] give for PM (or $P'M'$) of

[1] Marshall explicitly confined his discussion to the case of elastic demands, although Graham did not. It is best, therefore, to regard the controversy as confined to the case of elastic demands. Cf. Viner, *op. cit.*, pp. 543–6.

G bales, is greater than OM" and that "there will be an advantage in speaking of OE [E's offer curve] *as moved to the right* by an increase in E's demand."[1] Marshall clearly means by a "given" increase in E's demand for G's goods an equi-proportional increase in the quantity of exports E will offer for each quantity of imports received from G; this is the same thing as an equi-proportional increase in the price E will offer for each given quantity of imports.

This being so, the reason for the contradiction in the solutions offered by Marshall and Graham emerges readily. It will be remembered that $\overline{dM}$, which occurs in the earlier formulæ, represented the *given* increase in the demand for G's goods, and hence was a datum. Under Marshall's assumption, however, it varies in turn with the elasticity of E's demand for imports. If $\overline{dX}$ is the postulated increase in the quantity of exports of E-goods that E will offer for the initial quantity of G-goods imported from G, $\Delta p = \frac{\overline{dX}}{M}$ is the increase in the price E will pay per unit. The increase in the quantity of G-goods E will demand at the initial price is approximately:

$$\overline{dM} = -\frac{M}{p} \cdot \alpha \cdot (-\Delta p) = \alpha \cdot \overline{dX} \tag{6}$$

Substituting (6) into (4), we get:

$$dp = \frac{\overline{dX}}{M\left(\frac{\eta_x - 1}{\alpha} + 1\right)} \tag{7}$$

Marshall's solution follows quite readily now. For stable situations and elastic G-demand ($\eta_x > 1$), the extent to which the terms of trade will become unfavourable to E will vary inversely with G's elasticity and directly with E's elasticity. However, when G-demand is inelastic ($\eta_x < 1$)—a case which Marshall excluded by assumption[2]—and the stability condition holds, Marshall's conclusion is inadmissible and the Graham conclusion holds even under the Marshall-type change in international demand.

The change in the volume of trade again is in conformity with Marshall's conclusions and can be obtained readily as:

$$M \cdot r_m \cdot dp = \frac{\overline{dX}}{\left(\frac{1}{\alpha} + \frac{1}{\eta_x - 1}\right)} \tag{8}$$

For stable situations and elastic G-demand the increase in the volume of trade will be greater, the greater are *both* G's and E's elasticities of demand for imports.

[1] Marshall, *op. cit.*, p. 342, Marshall's italics.

[2] See footnote 1, p. 76.

We thus see that, where stability obtains and G-demand is elastic, the Graham conclusions hold when the change in international demand is defined in terms of a change in the quantity demanded at given terms of trade; whereas the Marshall conclusions hold when the change in international demand is defined in terms of a change in the price at which the given quantity is demanded.

C. *Generalisation of the Problem*

Our discussion points directly to a more general proposition in the theory of value, of which the Marshall–Graham controversy is an illustration. This is that the answer to the problem of how the elasticity of demand (supply) affects the extent to which a shift in demand (supply) alters the price and quantity exchanged depends on the precise way in which the shift is defined. There are two possible definitions of such a shift:

(*a*) a change in the quantity demanded (supplied) at a given price; and

(*b*) a change in the price at which a given quantity is demanded (supplied).[1]

According to which definition is chosen, the influence of the elasticity of the shifted curve on the effect of the shift will be different, as follows, if stability is assumed:

(i) An increase in demand will produce a greater increase in quantity exchanged, and a greater increase in price—

(1) on definition (*a*), the *less* elastic is the demand;
(2) on definition (*b*), the *more* elastic is the demand;

and conversely.

(ii) An increase in supply will produce a greater increase in quantity exchanged, and a greater reduction in price—

(1) on definition (*a*), the *less* elastic is the supply;
(2) on definition (*b*), the *more* elastic is the supply;

and conversely.

D. *Concluding Observations*

Both ways of construing a change in demand—change in quantity demanded at a given price, and change in price at which a given quantity is demanded—may be useful in the analysis of international trade problems. Broadly speaking, Graham's approach is likely to be more convenient when the problem is to examine the effects of some change on the volume and terms of international trade, when the conditions of international competition are

[1] Definition (*a*) is the Graham-type; definition (*b*) is the Marshall-type. The former corresponds to Hicks' *p*-theory; the latter to Hicks' *q*-theory (Hicks, *A Revision of Demand Theory* (O.U.P., 1956)).

assumed constant, since the direction of change of international equilibrium can be predicted from the effect of the change on quantity demanded at the initial price. Examples are the transfer problem and the effect of economic expansion on international trade equilibrium.[1] Marshall's approach, on the other hand, is likely to be more convenient when the problem concerns the effects of a change in a country's commercial policy on its internal equilibrium prices and quantities, since the direction of change of this equilibrium can be predicted from the effect of the tariff on the quantity of imports demanded at the initial internal price, and of the corresponding reduction of the external price on the quantity of imports the foreigner would supply. Marshall himself used this technique for the analysis of tariffs and subsidies; a more recent example of its successful application is Metzler's classic analysis of the case in which a tariff shifts production towards exports.[2]

II. Edgeworth *vs.* Nicholson on the Effect of an Improvement in Production on Foreign Trade and Welfare

Edgeworth, in the first of his three celebrated articles on "The Theory of International Values" in this Journal, argued that where there has occurred "a diminution . . . in the cost of production of an exported article," an extension of Mill's analysis indicates that "the improvement may prove detrimental to the exporting country." While claiming that his proposition is "sufficiently supported by common sense," Edgeworth demonstrated it in the context of a model of complete specialisation in production of exportables and in consumption of importables, arguing that the foreign elasticity of demand for the country's exportables should be less than unity for such impoverishment to occur in the context of his model.[3]

Nicholson, in his *Principles*, raised objection to Edgeworth's proposition on the ground that "If, however, we introduce money, this case is seen to work out differently"[4] and that Edgeworth's model was highly restrictive.

Edgeworth returned briefly to the subject in this Journal to argue that the introduction of money would not affect the proposition; and, further, that, although his proposition had been demonstrated with respect to his restrictive model, it was clearly not confined to it and should be demonstrable in the context of models of incomplete specialisation.[5]

[1] H. G. Johnson, *International Trade and Economic Growth* (Allen & Unwin Ltd., 1958), Chapters III and VII. Also J. Bhagwati, "International Trade and Economic Expansion," *American Economic Review*, Vol. 48, December 1958, pp. 941–53.

[2] Marshall, *op. cit.*, pp. 344–6. Metzler, "Tariffs, the Terms of Trade and the Distribution of National Income." *Journal of Political Economy*, Vol. 57, February 1949, pp. 1–29.

[3] Edgeworth, "The Theory of International Values," Economic Journal, Vol. 4, 1894. The argument set out in the text is from pp. 40–1.

[4] Nicholson, *The Principles of Political Economy*, Vol. II (London, 1897), p. 311.

[5] Edgeworth, "On a Point in the Theory of International Trade," Economic Journal, Vol. 9, 1899, pp. 125–8.

In his *Theory of International Trade* Bastable entered the controversy to argue in favour of Edgeworth, seeking to demonstrate Edgeworth's result, in terms of a model of incomplete specialisation in consumption along familiar classical lines, by showing how the country with the postulated improvement may, as a result of inelastic foreign demand, find herself with less of both exportables and importables than prior to the improvement. Bastable then proceeded to state the proposition that: "It is only where the benefit from improvement is smaller than the advantage of interchange that loss could result from it." [1]

A. Edgeworth Model: Complete Specialisation in Production and in Consumption

Edgeworth postulates that the country with the improvement in technique produces only exportables and consumes only importables. This remarkable model makes for the simplest, if not the most persuasive, demonstration of Edgeworth's proposition.

Thus, using the notation introduced in Section I, assume E to be the country with the postulated improvement. Then, the Edgeworth model amounts to arguing: (1) the Marshall-type increment in supply of exports: $\overline{dX}$; (2) that α is unity; and (3) that E's welfare varies directly with the quantity of her imports.

From formula (8) it follows then that E will be impoverished by the improvement if

$$\frac{\overline{dX}(\eta_x - 1)}{\eta_x} < 0 \tag{9}$$

which yields us the Edgeworth condition that $0 < \eta_x < 1$ for the country to be damnified by the improvement.

B. Model of Complete Specialisation only in Production

Where, however, consumption of both exportables and importables obtains, different and more complex analysis becomes necessary to establish Edgeworth's proposition.

What we must now discover is the condition under which, in this model, the gain directly accruing from the improvement is outweighed by the loss from the resultant deterioration in the terms of trade.[2] This can be done readily. Let K be defined as country E's productive capacity, which is always fully employed and is measured in terms of the output of exportables that E would produce at the initial terms of trade. Then $\overline{dK}$ is the increase

[1] Bastable, *The Theory of International Trade* (Macmillan, 1903), 4th edition (revised), pp. 185 and 186–7. Bastable also correctly dismisses Nicholson's contention that the introduction of money would affect the validity of the result.

[2] This argument is to be found in a rudimentary stage in Edgeworth's 1899 ECONOMIC JOURNAL note, *op. cit.*, as also in his earlier 1894 article, *op. cit.* (p. 41): "The case of an improvement in the process of manufacture of an article which is both exported and consumed at home . . . is a compound between the certain gain to the native consumer and the possible loss to the home country in the way of foreign trade."

in real income directly resulting from the postulated improvement. To measure the loss from the deterioration in the terms of trade, we must first discover the change in the terms of trade resulting from the improvement; this is found simply by substituting for $\overline{dM}$ in formula (4) the expression $m \,.\, \overline{dK}$, in which m is the marginal propensity to consume importables. The loss of real income due to this change in the terms of trade is approximately the increase in the cost of the initial volume of imports:

$$M \,.\, dp = \frac{m \,.\, \overline{dK}}{(\eta_x + \alpha - 1)} \tag{10}$$

It follows, then, that E will be impoverished by the improvement if

$$\overline{dK} < \frac{m \,.\, \overline{dK}}{(\eta_x + \alpha - 1)}$$

i.e., if

$$(\eta_x + \alpha - 1) < m \tag{11}$$

This condition can be fulfilled without violating the stability condition; hence Nicholson's second objection, concerning the restrictiveness of the model used by Edgeworth, is refuted.

Since α can be decomposed into $m + \varepsilon$, where ε is an expenditure-compensated elasticity of demand, the condition for impoverishment can be rewritten as

$$\eta_x < 1 - \varepsilon \tag{12}$$

This formula shows, as might be expected, that for impoverishment to ensue both the foreign demand for exports and the domestic (expenditure-compensated) demand for imports must be inelastic.

C. Model of Incomplete Specialisation in both Production and Consumption

The analysis resulting in formula (11) can be easily extended to the case where the country is producing and consuming both exportables and importables. All that is required to do is (*i*) to rewrite m in equation (11) as $c - h$, the difference between the marginal propensity to consume the importable good (c) and the proportion of the increase in productive capacity that would take the form of production of importables if the terms of trade remained at the initial level (h); and (*ii*) to recognise that the elasticities of international demand η_x and α now depend on the elasticities of transformation of exportable goods into importables in domestic production, as well as on the elasticities of final demand.[1]

While the possibility of increasing domestic production of importables in

[1] The actual reworking of the formula along these lines may be found in J. Bhagwati, "Immiserizing Growth: A Geometrical Note," *Review of Economic Studies*, Vol. 25, June 1958, pp. 201–5; and in H. G. Johnson, *op. cit.*, p. 76.

response to an increase in their price introduces a factor tending to raise elasticities of international demand and so increase the restrictiveness of the conditions required for the Edgeworth case, the possibility that the improvement may lead to a decrease in domestic production of importables works in the opposite direction. Since h can be negative, m can exceed unity and impoverishment can occur even if international demands are elastic.

The theoretical analysis of the effects on production of an improvement in technique in an industry, for the standard two-good two-factor constant-returns model of international trade, may be summarised as follows.[1] Assuming initially unchanged factor prices and no change in factor employment in the other industry, technical progress in an industry has two effects: except when it is "neutral," it releases a quantity of one of the factors from the industry; and it reduces the unit cost of production. At unchanged factor prices the quantity of the factor which is released must be absorbed by an expansion of the industry which uses it relatively intensively, accompanied by a contraction of the other industry (which contraction releases the amount of the other factor required to co-operate with the released factor in the combination optimal at the given factor prices). At unchanged commodity prices the reduction of cost in the industry where the improvement has occurred must be offset by a shift of resources into that industry out of the other, which will raise the price of the factor used relatively intensively in that industry and cheapen the factor used relatively intensively in the other industry, so restoring the initial comparative cost ratio.[2]

It follows that if progress in an industry is (*a*) neutral, so that only the second adjustment is called for; (*b*) saving of the factor used relatively intensively in the industry, so that both adjustments work in the same direction; or (*c*) not sufficiently saving of the factor used relatively unintensively in the industry for the first adjustment to outweigh the second; then production in the other industry will fall. Conversely, if progress is (*d*) sufficiently saving of the factor used relatively unintensively in the industry for the first adjustment to outweigh the second, output in the other industry will rise, and in the extreme case output of the industry in which progress occurs will actually decrease.

Thus an improvement in the export industry which is neutral, or saving of the factor used intensively in that industry, will increase demand for imports by both increasing consumption and reducing domestic production of the importable good; and impoverishment may result from such an im-

[1] See H. G. Johnson, *op. cit.*, for the analysis of neutral progress and a brief indication (p. 78, n. 20) of the required line of argument on cases of biased progress; and Findlay and Grubert, "Factor Intensities, Technological Progress and the Terms of Trade," *Oxford Economic Papers*, Vol. 11, February 1959, pp. 111–21, for the analysis of the effects of biased progress.

[2] Since the factor used relatively unintensively in the progressing industry falls in price, more than the whole of the benefit of progress goes to the other factor. If the marginal propensities to consume of owners of the two factors differ, this redistribution effect may reduce consumption of one of the goods. This possibility, which could make c negative, is ignored in what follows.

provement, even if international demands are elastic.[1] But improvements in the export industry which save the factor used relatively unintensively there do not necessarily give rise to the possibility of impoverishment. On the contrary, improvements sufficiently strongly saving of the factor used relatively unintensively in the export industry may, by increasing domestic production of imports, actually reduce the country's demand for imports. In this case the country will enjoy a double gain—in total output, and through improved terms of trade—instead of a gain in output offset in whole or part by a terms of trade loss.

Edgeworth was therefore incorrect in implying that any improvement which reduced costs in the export industry might prove detrimental to the exporting country. On the other hand, modern analysis points to a possibility not mentioned by Edgeworth, that an improvement in the import-competing industry, if it is sufficiently saving of the factor used relatively intensively in the export industry, will increase the country's demand for imports and so create the possibility of a net loss of welfare from the improvement. Again, this possibility arises even if international demands are elastic.

D. Concluding Observations

We have shown that it is possible, contrary to Nicholson's assertion, to demonstrate the possibility of impoverishment of a country from domestic improvement in the context of models less restrictive than Edgeworth's. Moreover, in the general case of incomplete specialisation we have shown that this possibility does not require inelasticity of international demands.

Also, whereas Edgeworth, Nicholson and Bastable confined their discussion (necessarily in view of their models) to improvement in the production of exportables, our analysis of the case of incomplete specialisation in production demonstrates, on the one hand, that not all improvements in the export industry will create the possibility of impoverishment, but, on the other hand, that impoverishment is possible even if the improvement occurs in the domestic production of the importable good, and thus further generalises the scope of Edgeworth's proposition.

Further, since the maximum loss that the country may suffer from adverse terms of trade cannot be greater than her gains from trade, the Bastable proposition follows that the necessary condition for Edgeworth's possibility to arise is that the direct gain from growth is less than the initial gains from trade. Our analysis again proceeds farther and establishes conditions for such impoverishment which are both sufficient and less restrictive.

Finally, it may be noted that Edgeworth correctly argued that where the country is thus damnified by the improvement, it follows " by parity of reasoning " that it " may be benefited by a restriction of its exports." [2]

[1] This proposition, and the following ones, assume the fulfilment of the stability condition and the absence of inferior goods.

[2] Edgeworth, Economic Journal (Vol. 4, 1894), p. 40.

Whatever the model used, it is clear that where impoverishment results from domestic improvement in production, the country can restrict its trade to advantage.

III. Marshall *vs.* Viner on Measurement of the "Net Benefit" from Trade

A. Marshall's Measure

In *Money, Credit and Commerce* Marshall measured the "net benefit" derived by a country from its international trade as the sum of the excesses of the unit prices at which the country would have purchased successive quantities of imports, over the equilibrium "rate of interchange" established in international trade.[1] In other words, he applied his concept of consumer's surplus to the problem, measuring the gain by the area between the demand curve and the price-line; though the application of the concept to the country's offer curve required considerable geometrical ingenuity, and the prices involved, as well as the surpluses, were expressed in terms of representative bales of export goods rather than money.[2]

Since the representative bales embody unit products of labour and capital, Marshall was able to measure the aggregate gain from trade to the world as a whole in terms of unit products of labour and capital, as the sum of the surpluses of the trading countries, measured in bales of their export goods. In addition, he stated the following proposition concerning a country's (G's) net benefit from trade: "the surplus is the greater, the more urgent is G's demand for a small amount of E's goods and the more of them she can receive without any great movement of the rate of interchange in her favour"[3]—*i.e.*, the higher the price G will pay for sub-equilibrium quantities, and the more elastic her demand in the sub-equilibrium quantity range.

B. Viner's Criticism and Amendment

Viner's criticism of Marshall's measure, set out in his *Studies in the Theory of International Trade*,[4] runs along lines which are by now familiar. He points out that Marshall's measure assumes that the offer curve is unaffected by whether or not the importing country pays the equilibrium price or the maximum price it is willing to pay for intra-marginal increments in its imports, which in turn implies constancy of the marginal utility of exportables. On the contrary, he argues, the marginal utility of exportables is greater, and therefore the price the country will pay for a marginal increment of imports less, the more that has been paid for the previous volume

[1] Marshall, *op. cit.*, Appendix J, Section 3, pp. 338–40.
[2] *Ibid.*, p. 339.
[3] *Ibid.*, pp. 339–40.
[4] Viner, *op. cit.*, pp. 570–5.

of imports; so that Marshall's measure exaggerates the amount of the surplus the country receives in trade. Because of this exaggeration, Viner claims, Marshall's measure may lead to improbable or meaningless magnitudes of the surplus.

In place of Marshall's measure Viner suggests going behind the offer curve to the country's utility function: deriving from it the offer curve as it would be if the country paid the maximum price it was willing to pay for each successive unit, and measuring the country's benefit from trade as the sum of the excesses (or deficiencies) of the prices shown on this curve for successive quantities of imports over the equilibrium price established in international trade. The offer curve so derived is, of course, the equivalent of the marginal valuation curve in welfare theory; and the measure it leads to is the true Marshallian consumer's surplus (the excess of what the consumer would be willing to pay for the equilibrium volume of imports over what he actually pays) as contrasted with the defective, exaggerated measure of it obtained by integrating the area under the demand curve. Thus Viner's measure is a theoretically sound version of Marshall's consumer's surplus concept, in the context of international exchange.

C. Alternative Measures of the Gains from Trade

Both Marshall and Viner employ the analytical tool of the offer curve—the aggregative version of the demand curve—and both are concerned with measurement according to the concept of benefit from exchange associated with the demand curve: consumer's surplus. Other concepts of benefit from exchange have since been developed, requiring the use of indifference curves for their exposition. The purpose of this section is to apply these concepts to the problem of the benefits derived from international exchange and to develop alternative measures of the gains from trade.

Three alternative approaches to the problem of measuring the gains from trade are available: Marshallian surplus, compensating variation and equivalent variation. The first assumes that the advantage of trade consists in the opportunity to exchange the equilibrium quantity of exports for the equilibrium quantity of imports, and measures the gain from trade by the amount of one good that could be extracted from the country without making it worse off than it would be in the absence of trade. The second and third both assume that the advantage of trade consists in the ability to exchange exports for imports at the equilibrium price ratio; but whereas the second measures the gain from trade by the amount of one good that could be extracted from the country (while leaving it free to trade at the equilibrium price ratio) without making it worse off than it would be in the absence of trade, the third measures the gain by the amount of one good that would have to be donated to the country to make it as well off without trade as it would be when free to trade at the equilibrium price.

Each measure can be made in terms of either of the two goods, exportables and importables. Since, in the world market, the country is a net producer of the former in order to be a net consumer of the latter, measures in terms of exportable goods (the cost of consumption of importables) may be regarded as measures of the country's gain in its capacity as a consumer, while

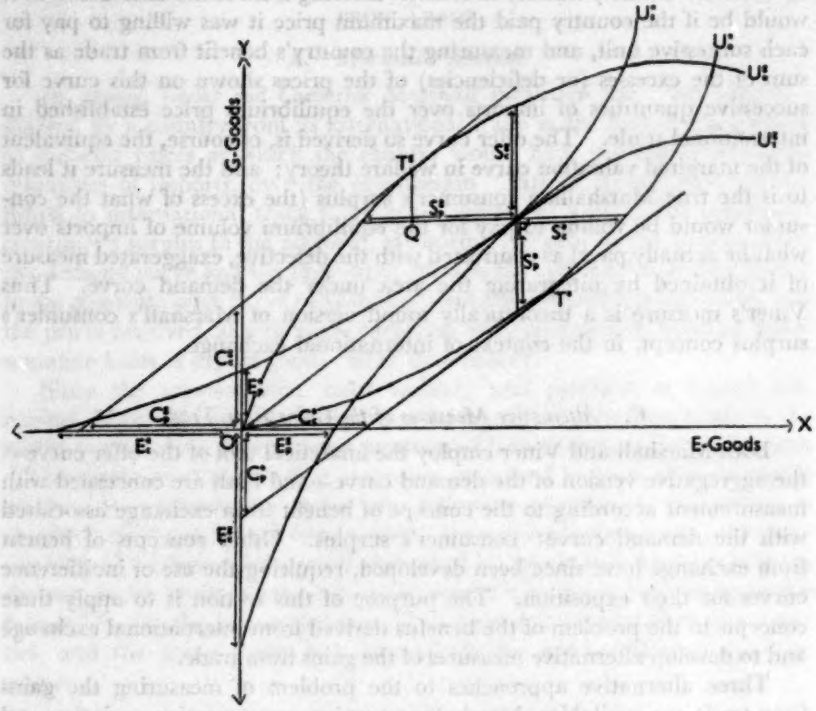

FIG. 1

measures in terms of importable goods (the reward for production of exportables) may be regarded as measures of its gain in its capacity as a producer. Consequently, the alternative measurements in terms of the exportable and importable goods may (at the risk of some confusion in the Marshallian terminology) be described as the consumer and producer measurements respectively. Thus there are six possible measures of the gains derived by a country from international trade—Marshallian consumer's and producer's surplus, consumer's and producer's compensating variation, and consumer's and producer's equivalent variation—and twelve in all for the (two-country) world as a whole.

The six measures for each country are illustrated in Fig. 1. Country E's exports are measured along OX, country G's along OY; P is the free-trade

equilibrium point at which the two countries' offer curves intersect, the slope of OP representing the equilibrium terms of trade. U_o^e and U_o^g represent the no-trade indifference curves, and U_t^e and U_t^g the free-trade equilibrium indifference curves of the two countries.[1] T^e and T^g are the points on the no-trade indifference curves with slopes equal to the equilibrium terms of trade. The three measures of the gains from trade are denoted by S, C and E respectively; the country whose gain is being measured is denoted by the superscript g or e, and the producer's and consumer's measures by the subscripts p and c respectively.

In the "normal" case represented in the diagram, with indifference curves strongly convex and neither good inferior, the Marshallian surplus must be less than the compensating variation; the consumer's equivalent variation must be greater than the consumer's compensating variation; and the producer's equivalent variation must be less than the producer's surplus. In other words, in this case the consumer-measures stand in the relationship $S_c < C_c < E_c$; and the producer-measures in the relationship $E_p < S_p < C_p$.[2]

All three types of measures are internationally additive, in the sense that the total gain of the world as a whole can be said to be equal to a certain quantity of one or the other country's export good. But this is a very limited statement, since the measure of total gain is valid only on the assumption that the total quantity is divided between the two countries in a unique proportion corresponding to the distribution of income at the trade equilibrium point.

D. Concluding Observations

The foregoing analysis of alternative measures of the gains from trade suggests some comments on the treatment of the problem by Marshall and Viner, and also leads to a more satisfactory measure of the gains from trade.

(1) All three types of the measures of benefit discussed here employ the no-trade indifference curve as a basis of comparison. It follows that Marshall's proposition concerning the conditions under which the benefit is likely to be large, which runs in terms of the characteristics of the offer curve, must

[1] These are to be construed as the trade-indifference curves introduced by Meade, *A Geometry of International Trade* (G. Allen & Unwin, 1952). It is interesting to note that, as Viner records, *op. cit.*, p. 576, Edgeworth, in his "On the Application of Mathematics to Political Economy," *Journal of the Royal Statistical Society*, Vol. 52, 1889, pp. 555–60, had already introduced, for measuring the net benefit from trade, a "no-gain from trade" curve, which he called a "collective utility curve," and had measured the gain from trade (for Germany) by a method exactly identical to our own. Whereas, however, Edgeworth's indifference curve was based purely on exchange analysis, the trade-indifference curve of Meade allows us to admit production into the model.

[2] Universal non-inferiority means that the slope with reference to the import-good axis of any point on the U_o curve is steeper than that on the U_t curve for the same quantity of exports, and less steep than that on the U_o curve for the same quantity of imports. Hence the distance between the two curves in the export direction increases, and in the import direction decreases, as the point on U_o moves towards the origin.

now be reformulated in terms of the properties of the no-trade indifference curve. The revised proposition, about the size of the Marshallian consumer's surplus, must involve the marginal rate of substitution between the goods in the absence of trade, and the shape of the indifference curve between the origin and the point corresponding to the equilibrium volume of imports: the consumer's surplus derived from trade will be larger, the greater the difference between the slope of the free-trade terms of trade line (*OP*) and the slope of the tangent to the no-trade indifference curve at the point of origin, and the higher the elasticity of substitution between the goods (along the no-trade indifference curve). Marshall's own proposition, in terms of the offer curve, is thus clearly incorrect except when the trade-indifference curves are homothetic.

(2) Viner's criticism of Marshall's measure, that "Marshall's method . . . is capable of producing such improbable results as a surplus, measured in G-bales, many times greater than the total amount of G-bales actually exported, and—if the *OG* curve is inelastic—may produce such meaningless results as a surplus, measured in G-bales, greater than the total amount of G-bales which G can produce" [1] is both equally applicable to his amended version of Marshall's measure and totally irrelevant. As is easily seen from contemplation of S_e'' in Fig. 1, it is perfectly easily conceivable that the gain from trade on Viner's measure (or the other two consumer-measures, though *not* the producer-measures) might exceed the total quantity of goods exported by the country. Nor is the possibility that the gain might exceed the total amount of exportables the country could *produce* ruled out by Viner's measure. This possibility does require that the no-trade indifference curve can be drawn for regions involving exports above the country's productive capacity, implying that the country can value negative consumption of exportables combined with positive consumption of importables; but the fulfilment of this requirement is itself implied by the usual practice of drawing the offer curve through the origin, which assumes that at some finite high price of importables the country becomes a net exporter of such goods. If this possibility is ruled out by assumption, however, the defective Marshallian measure, which exaggerates the true surplus, could still produce the requisite result, so that Viner's argument is justified to that extent.

(3) All three of the measures of gain discussed in the previous section are open to a logical objection. If the quantity of the relevant good which measures the gain were actually extracted from the country the equilibrium volume and terms of trade would be different from their initial equilibrium values: if the gain were extracted in exportable goods the volume would be smaller and the terms of trade more favourable than initially, and the converse if the gain were extracted in importable goods. The measures are, therefore, in a sense logically inconsistent.

[1] Viner, *op. cit.*, p. 572.

In order to avoid such inconsistency, the gain must be measured by the quantities of the two goods which, if extracted, would leave the international trade equilibrium unchanged. The simplest such measure, illustrated for country G, is $T'Q$ of G-goods and QP of E-goods, which quantities might be extracted by an income tax, the proceeds of which are spent in buying these amounts of the goods. But T' is only one point on the no-trade indifference curve, that at which the marginal rate of substitution between the goods is equal to the terms of trade; any of the other points could be reached, in principle at least,[1] by a combination of excise taxes and subsidies (remembering that an income tax is, in this model, equivalent to an excise tax at the same rate on both goods). Thus the gain can be thought of as a transformation curve between the two goods, formed by the no-trade indifference curve referred to the origin P; for simplicity, the curve could be confined to the range bounded by the two Marshallian surpluses, within which the quantity of neither good is negative. By extension of this notion, the value of the opportunity to trade can be regarded as a family of such transformation curves, one for each point on the foreign-offer curve; or as a single curve formed by points on the foreign-offer curve and the points on the no-trade indifference curve at which the marginal rate of substitution between the goods is equal to the terms of trade.

IV. Marshall's Theorem Concerning the Stability of International Equilibrium

Our fourth problem is whether, if international demands are so inelastic in the neighbourhood of an equilibrium point as to make that equilibrium unstable, this necessarily implies the existence of at least two points of stable equilibrium, one at a higher and one at a lower exchange ratio than the (unstable) equilibrium ratio. This problem is rather different from the preceding three, in that no well-recognised controversy over it is embedded in the literature of international trade, though clearly opposed views on it have been stated by different writers.

The proposition that instability of equilibrium implies an odd number of equilibrium prices, alternatively stable and unstable, was stated by Marshall as follows: [2]

> " 9. *On the extreme hypothesis that each of two imaginary countries, in exclusive trade with one another, had an urgent demand for a small quantity of the other's goods, but could find no good use for any large quantity of them, then there might be several positions, alternatively stable and unstable, of equilibrium between them.*
>
> " If OE and OG both belong to this Exceptional Demand class, they

[1] For instance, by negative purchases of goods.

[2] Marshall, *op. cit.*, Appendix J, Section 9, p. 352.

may cut one another three (or any other odd number of) times, not counting *O*. The first of these reached from *O* in either direction, will be stable, the second unstable, the third stable and so on. . . ."

As is clear from the quotation, Marshall regarded inelasticity of international demand (and therefore instability of equilibrium) as of no conceivable practical relevance. Experience in the 1930s changed opinion on this score, and the conditions required for instability were re-explored in connection with the theory of devaluation and floating exchange rates. But the classic treatments of this subject did not investigate the question of the existence of stable equilibria at all thoroughly, and in *obiter dicta* implied agreement with the Marshallian position. Joan Robinson, in "The Foreign Exchanges," [1] asserts the existence of a stable lower equilibrium rate of exchange on the grounds that "a sufficiently violent rise in the price of imports must ultimately choke demand, and even if exports fail to react, in the flurry of the moment, the value of imports must somewhere begin to fall off." Abba Lerner, in *The Economics of Control*,[2] while arguing generally in terms of constant elasticities which may be too low for stability, implies agreement with the Marshallian proposition in the following passage:

> "One country after another is forced off the gold standard, finds its currency appreciating without this affording much relief, and is able to find a stable position only after a long fall in the value of its currency and the introduction of special restrictions on trade have so altered the situation that the elasticities are no longer so low."

On the other hand, Lloyd Metzler, in "The Theory of International Trade," [3] does not mention the Marshallian proposition, but writes as if elasticities of international demand were the same at all levels of price, though increasing with the passage of time. The only explicit attack on the Marshallian proposition known to us is contained in Paul Samuelson's "Disparity in Postwar Exchange Rates," [4] where it is remarked, *à propos* a restatement of the classical position in Joan Robinson's "The Pure Theory of International Trade": [5]

> "At the critical point in her argument she assumes as obvious what is not universally necessarily true. She says, 'at some point the goods become so expensive relative to world money incomes that demand

[1] J. Robinson, *Essays in the Theory of Employment* (Oxford: Blackwell, 1947), Part III, p. 201.
[2] A. P. Lerner, *The Economics of Control* (New York: Macmillan, 1944), Chapter 28, p. 380.
[3] *A Survey of Contemporary Economics*, H. S. Ellis ed. (Blakiston, 1948), Chapter 6.
[4] *Foreign Economic Policy for the United States*, Seymour Harris ed. (Harvard U.P., 1948), Chapter 22, p. 409, n. 14. In addition, Samuelson makes the theoretically far more important point that, if demand can be financed from an accumulated stock of assets as well as from income, there is no reason why devaluation of any degree should restrict demand to what can be paid for from current income. But we shall restrict our argument to the offer-curve analysis.
[5] *Review of Economic Studies*, Vol. 14, 1946–47, pp. 100–2.

turns elastic . . . and there is some level . . . at which exports fall to zero.' I grant that it is customary to draw demand curves so that at high prices they do touch the price axis and become elastic. Probably this is realistic. But it is not universally necessary as a matter of logic. It is easy to specify indifference curves such that demand is *always* inelastic."

More recently, the Marshallian proposition has been revived as part of the argument for the adoption of flexible exchange rates.[1]

The Marshallian proposition may be illustrated by reference to Figs. 2 (*a*) and 2 (*b*). In Fig. 2 (*a*), which is based on Fig. 20 of Appendix J to

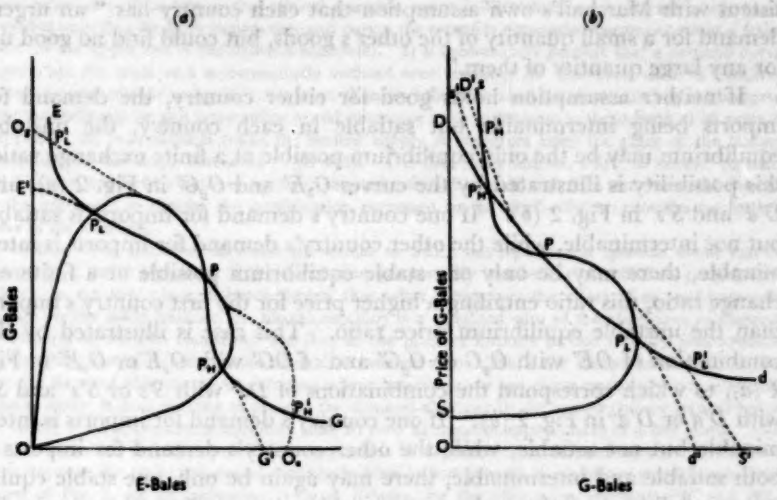

FIG. 2

Money, Credit and Commerce, *OE* and *OG* are the reciprocal demand curves of *E* and *G*; in Fig. 2 (*b*) these are translated into the more familiar concepts of demand and supply for imports as functions of the price of imports, *Dd* being E's demand for imports and *Ss* G's supply curve. *P* is a point of unstable equilibrium and there are stable equilibria at P_H and P_L, representing respectively a higher and a lower price of E's imports than the price at *P*.

It is at once apparent from the diagrams that the Marshallian proposition is a consequence of the way in which the curves are drawn. Each reciprocal demand curve has two characteristics:

(i) it passes through the origin, implying that there exists a finite

[1] Milton Friedman, "The Case for Flexible Exchange Rates," *Essays in Positive Economics* (University of Chicago Press, 1953), Chapter 6, p. 160, n. 4.

high price of imports which will choke off demand for them; *i.e.*, the demand for imports is terminable; [1]

(ii) it does not join the import-good axis as the price of imports falls, implying that the quantity of imports demanded increases indefinitely as their price falls; *i.e.*, the demand for imports is insatiable.

It is these characteristics which ensure that the reciprocal demand curves (demand and supply curves) intersect at least once above and below the (unstable) equilibrium price. But neither of these characteristics is a necessary logical consequence of demand theory: [2] on the contrary, both are empirical assumptions. Moreover, both characteristics appear inconsistent with Marshall's own assumption that each country has " an urgent demand for a small quantity of the other's goods, but could find no good use for any large quantity of them."

If neither assumption holds good for either country, the demand for imports being interminable but satiable in each country, the unstable equilibrium may be the only equilibrium possible at a finite exchange ratio; this possibility is illustrated by the curves O_eE' and O_gG' in Fig. 2 (*a*), and $D'd'$ and $S's'$ in Fig. 2 (*b*). If one country's demand for imports is satiable but not interminable, while the other country's demand for imports is interminable, there may be only one stable equilibrium possible at a finite exchange ratio, this ratio entailing a higher price for the first country's imports than the unstable equilibrium price ratio. This case is illustrated by the combination of OE' with O_gG or O_gG' and of OG' with O_eE or O_eE' in Fig. 2 (*a*), to which correspond the combinations of Dd' with $S's$ or $S's'$ and Ss' with $D'd$ or $D'd'$ in Fig. 2 (*b*). If one country's demand for imports is interminable but not satiable, while the other country's demand for imports is both satiable and interminable, there may again be only one stable equilibrium possible at a finite exchange ratio, this ratio entailing a lower price for the first country's imports than the unstable equilibrium price ratio. This case is illustrated by the combination of O_eE with O_gG' and of O_gG with O_eE' in Fig. 2 (*a*), to which correspond the combinations of $D'd$ with $S's'$ and $S's$ with $D'd'$ in Fig. 2 (*b*). But if the demand for imports is both insatiable and terminable in one country, or satiable but terminable or insatiable but interminable in both, there will be a stable equilibrium at both a higher and a lower exchange ratio than the unstable equilibrium price ratio. These cases are illustrated in Fig. 2 (*a*) respectively by the combinations involving OE or OG, the combination of OE' and OG', and the combination of O_eE and O_gG; to these correspond combinations involving Dd

[1] Each country's reciprocal demand curve must cut its export axis somewhere, as the country cannot spend more than its total national income on imports; but intersection at any other point than the origin implies that an infinitely high price is required to end demand.

[2] Consider, on the one hand, a bread-and-water economy or one relying on imports of a raw material not producible at home; on the other hand, the case of inferior goods.

or *Ss*, the combination of *Dd'* and *Ss'*, and the combination of *D'd* and *S's* in Fig. 2 (*b*).[1]

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University of Manchester.

[1] Our analysis thus demonstrates the fallacy of the assertion made by Milton Friedman (*op. cit.*) and more recently alleged to be proved by Egon Sohmen ("Demand Elasticities and the Foreign Exchange Market," *Journal of Political Economy*, Vol. 65, October 1957, pp. 431–6) that an unstable foreign-exchange market equilibrium is necessarily enclosed by stable equilibrium points. Sohmen argues: "It is crucial for our purposes, however, that a stable equilibrium point exists *below* as well as above the critical unstable range. This outcome is always guaranteed, provided only that for both import demand curves the quantity demanded becomes zero at a finite price (at the upper end of the demand schedule). It is theoretically possible that a demand curve approaches the price axis asymptotically without ever reaching it. But even then its elasticity cannot forever remain below unity by more than an infinitely small amount with limited budgets, since expenditures on this commodity would otherwise have to increase without limit as its price is increased. In international trade, the limited supply of resources takes the place of the budget constraint for the single consumer" (p. 434). The first three sentences are, of course, correct; but Sohmen apparently believes, quite erroneously, that the fourth and fifth sentences add enough to the argument to dismiss the qualification expressed in the third—for he provides no further proof of his assertion.

In fact, these sentences illustrate the extent to which *non sequitur* and *ignoratio elenchi* can be accepted as valid argument if the conclusion purportedly reached is of sufficient propaganda value. In the first place, Sohmen forgets that what determines the effect of an exchange-rate change on the trade balance (on his assumption) is a weighted sum of the elasticities of demand for imports in the two countries; *and* that as the price of imports in one country rises towards infinity the price of imports in the other falls towards zero. While the budget constraint implies that the demand elasticity in the country where import prices are rising must approach infinitely close to unity, it does nothing to prevent the demand elasticity in the country where import prices are falling from approaching infinitely close to zero as imports approximate to a free good. The budget constraint therefore provides no argument in support of the contention that devaluation must improve the trade balance at sufficiently high import prices: the contrary possibility is illustrated in Fig. 2, for an increasing price of E-bales, by the offer-curve segments *PE'* and PO_y. Secondly, even were this contention established, it would not prove the existence of a stable equilibrium position. Further exchange depreciation may always reduce the amount of an adverse trade balance, without ever actually eliminating it, as is illustrated in Fig. 2, for an increasing price of G-bales, by the offer-curve segments *PG'* and PO_x. To travel hopefully is not necessarily to arrive.

Contrary to Sohmen's assertion that "the main argument of this note does not require any position on empirical questions" (p. 432), the question of the existence of stable equilibria cannot be solved by theoretical argument; it can only be deduced from empirical assumptions about the nature of demand for imports in the real world. Of the two simplest assumptions that will guarantee the result—that at some high price of imports, substitution in consumption and/or production will eliminate demand for imports, and that no finite quantity of imports could satiate the demand for them—the former is probably the more plausible. Both assumptions, however, raise the question of the time required for the adjustment of production and consumption patterns to a change in relative prices, the failure to investigate which may be the most important source of disagreement between economists about the efficacy of exchange-rate adjustments.

THE SHORT-TERM EFFECT OF THE LOWERING OF IMPORT DUTIES IN GERMANY

THERE has been, and will be, much discussion on the impact of the lowering of import duties. These discussions are in general always in the abstract. For until now it has not been possible to gain any insight into the influence and significance which import duties have in the practice of modern economic life, for the simple reason that integrated tariff reductions on an appreciable scale have never yet occurred.

A dread of the economic consequences of substantial (or even small) tariff reductions is apparently an important counsellor to the governments of many countries.

For some years past, however, an interesting experiment has been conducted in Germany, consisting in the application of drastic tariff reductions, notably in the industrial sector. Germany thus affords the only noteworthy practical instance in which the effect of tariff reduction on economic life can be studied. It is therefore of primary use to have some notion of the development of the tariff incidence in that country.

It appears that within a short period import duties were more than halved. Notably in the years 1956 and 1957 the great blow was struck under the name of "konjunkturpolitische Zollsenkungen." In 1956 the duties on industrial products which ranged from 1 to 16% were lowered by 20% and those ranging from 17 to 25% by 25%, while all others were reduced to 21%.

As the duties on finished industrial products largely came within the category of 17–25% or exceeded this, the reduction for this group of products at the first round amounted to more than 25%.

In 1957 a second round of reductions took place with an all-round lowering of 25% per tariff item.

Considering that the world is not accustomed to much in the way of tariff reductions, and given the short period in which they were effected, the German lowering of import duties is nothing short of impressive.

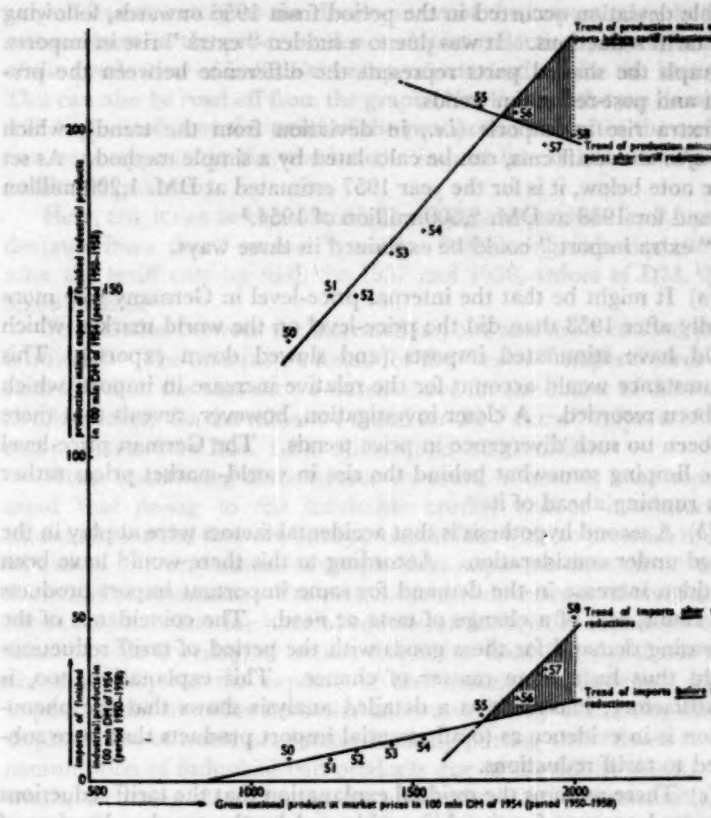
Of course, it can never be conclusively demonstrated how, in the concrete, the German tariff reductions have affected the German economy, but it can be discovered whether particular economic relations, which were statistically perceptible before the tariff reduction, have changed since it took place.

The following is an attempt to do so. It will be found that there is some difference between the changes that have occurred in the sector of industrial end-products and those which have taken place in that of semi-manufactured goods. These two sectors will therefore be treated separately.

With regard to industrial end-products the relations between the following quantities are traced below for a series of years:

(*a*) the development of national income (as an important determinant of the demand for imported industrial end-products) and the imports of industrial end-products subject to tariff reductions, both before and after the tariff reductions;

(*b*) the development of national income and the production of



GRAPH 1.—End products. The relation of national income (horizontal) to imports of finished industrial products (vertical; see lower graph) and to production minus exports of finished industrial products (see upper graph).

industrial end-products subject to tariff reductions, both before and after the tariff reductions.

The advantage of this approach is that it eliminates those movements which are conditioned by the normal process of economic " growth," so that the " net " effects of the reduction can be ascertained with greater accuracy.

In the accompanying graph (No. 1) the interrelation between the various

quantities can be read off. Horizontally the national income for a number of years has been plotted, vertically the imports of industrial end-products in the same years (bottom lines) and the production intended for home use (top lines). The graph brings some interesting facts to light.

It appears that in the period before the tariff reductions (1950–55) there was a reasonably constant relation between income and imports. An appreciable deviation occurred in the period from 1956 onwards, following the great tariff reductions. It was due to a sudden " extra " rise in imports. In the graph the shaded parts represent the difference between the pre-reduction and post-reduction trends.

The extra rise in imports (*i.e.*, in deviation from the trend), which occurred *after* the tariff cuts, can be calculated by a simple method. As set out in the note below, it is for the year 1957 estimated at DM. 1,200 million of 1954, and for 1958 at DM. 2,500 million of 1954.[1]

This " extra import " could be explained in three ways.

(*a*) It might be that the internal price-level in Germany rose more rapidly after 1953 than did the price-level on the world market, which would have stimulated imports (and slowed down exports). This circumstance would account for the relative increase in imports which has been recorded. A closer investigation, however, reveals that there has been no such divergence in price trends. The German price-level came limping somewhat behind the rise in world-market prices rather than running ahead of it.

(*b*) A second hypothesis is that accidental factors were at play in the period under consideration. According to this there would have been a sudden increase in the demand for some important import products as a result, say, of a change of taste or need. The coincidence of the increasing demand for these goods with the period of tariff reductions would thus be a mere matter of chance. This explanation, too, is unsatisfactory, inasmuch as a detailed analysis shows that the phenomenon is in evidence as to all essential import products that were subjected to tariff reductions.

(*c*) There remains the residual explanation that the tariff reductions do indeed account for the shifts evidenced by the graph. In view of the trends of the graphs and the times of the various reductions this would be the most plausible explanation.

This explanation will be reinforced when we compare in the final paragraph of this paper the remarkably different behaviour of the

[1] Assuming y = imports of finished industrial products and x = national income, the regression line for imports (in the pre-reduction period) answers to the formula: $y = \cdot 022\, x - 19{\cdot}6$.

For the national incomes (x) in 1957 and 1958 (x 1957 = DM. 192 milliard and x 1958 = DM. 201 milliard) we find as corresponding " theoretical " import values (y) the amounts of DM. 2,200 million and DM. 2,500 so that the " extra " import amounted to about DM. 1,200 million and DM. 2,500 million respectively in the years 1957 and 1958.

imports of finished products (subject to substantial tariff reductions) and the imports of semi-finished products (subject to much smaller tariff reductions).

The Extent and Economic Consequences of the Lowering of the Tariff

Just as interesting as the development of the import trade in industrial end-products in the pre-reduction and post-reduction periods is the course of the production of industrial end-products destined for the home market. This can also be read off from the graph (No. 1) [1] (see the top lines), when it will be noticed that the trend of the production line after the tariff reduction runs opposite to the trend of the import line of the same category of industrial products.

Here, too, it can be calculated by a simple method how far the production deviates from the "normal" trend. Calculating this deviation arising after the tariff cuts we find, for 1957 and 1958, values of DM. 2,500 and 3,200 million.[2]

The relation between the increased imports and the decreased production is obvious. The amount we found for the "extra" imports turns out to be even less than the amount we stated above for the extent of the relative fall in production; for the values we found for the "extra" imports of industrial end-products were DM. 1,200 million and 2,500 million.

When considering these figures we must, of course, bear constantly in mind that owing to the inevitable crudity and/or inaccuracy of the statistical material they are but approximations with no pretence to accuracy. Moreover, the very nature of the problem imposes a limit on the number of statistical observations. Yet even with a wide margin of error the figures found are such that the natural conclusion is that the expansion of imports following the lowering of import duties has been largely, if not wholly or almost wholly, at the expense of the national production. The larger imports could therefore be better accounted for by attributing them to the displacement of home production than by putting them down to increased consumption of industrial end-products due to the fall in prices. In other words, assuming that the figures given above are representative for the actual situation, the German tariff reductions seem to have had a great substitution effect and no effect, or but a slight one, on consumption.

It may in general be contended that the German tariff reduction resulted

[1] Generally speaking, one ought to be careful in handling this kind of graph, because it has to be borne in mind that the production of industrial end-products is a factor in the determination of the national income. The present graph was nevertheless considered to be justified, because the output of end-products subject to tariff reductions made up only 20% of the national income.

[2] The regression equation for the production of industrial end-products before tariff reduction is $y = 0{\cdot}111x + 66$ (y being production and x national income). The amounts here given represent the deviations, as in the case of the "extra" rise in imports, of the actual value of industrial production from the "theoretical" values found for 1957 and 1958 on the basis of the regression equation.

in a fall in import prices of finished industrial products by 10–12½%.[1] The "extra" rise in imports was, at least in the short period under review, by 100%,[2] which would imply an import price elasticity of about 8–10. Through this high coefficient the home production could evidently acquire a downward course—in an absolute sense, which appears so clearly from Graph 1.

To one more aspect attention should, however, be drawn in this connection. The production figures stated take no account of the volume and the development of the export trade. If we look at the course of the total production of industrial end-products we see quite a different picture from that presented by the graph presented above.

The rise in the total output of industrial end-products took the following course:

Increase of the Total Production Volume of Industrial End-products (Including Exports) on Each Preceding Year

1951.	1952.	1953.	1954.	1955.	1956.	1957.	1958.
+24·6%	+7·1%	+13·4%	+12·0%	+20%	+7%	+5%	+3·7%

In other words, it is particularly the expanding export possibilities of Germany which have provided a substantial compensation for the adverse effects which the increasing imports have had on the home production. On balance, then, notwithstanding the tariff reductions the production could, thanks to the available export opportunities, pursue an upward trend.

The Effect of the Tariff Reductions on German Welfare

In the foregoing analysis of the economic consequences of the tariff reductions we have tried as much as possible to eliminate the results of normal economic growth. With this knowledge in mind it is possible to form by way of an experiment roughly a "schematic" and "static" picture of the impact of the German tariff reduction on German welfare. Such a schematic representation is provided by Graph 2.

$PQ : QR$ represents the ratio between home production and imports before the tariff reduction; $ST : TU$ represents that ratio after the reduction. RU represents the rate of the tariff (the total tariff being RL; $RU = \frac{1}{2}RL$). Since the statistical analysis given in the preceding paragraphs did not indicate an important impact of the tariff reductions on domestic consumption, the demand curve V has been drawn as a vertical curve, indicating an elasticity nil or almost nil.

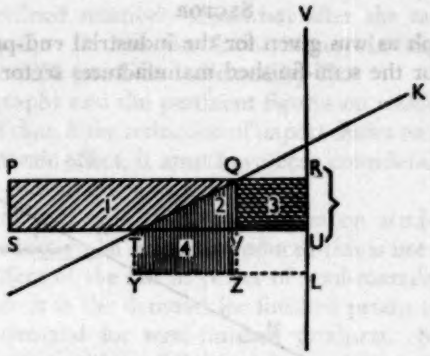
K is then the total-cost curve for the German economy.

[1] As far as can be ascertained, the tariff reduction has had no effect on the terms of trade. Indeed, this is hardly likely, seeing that the German market, as compared to the world market for finished industrial goods (United States, United Kingdom, Japan and others), is still of a modest size and monopolies that control the world market are scarce. Moreover, such an effect on terms of trade would only go to raise the elasticity coefficient.

[2] These 100% have been found by computing, for the year 1958, the difference between the "theoretical" and the actual imports (see also Graph 1; the "theoretical" imports in that year amounted to DM. 2,500 million, the actual imports to DM. 5,000 million.

A fall (*RU*) in the price-level owing to the lowering of import duties results in a loss (*PSTQ*) of producers surplus. Consumers, on the other hand, obtain a general gain in income from the fall in prices, a gain which may be equated to the extent of the price fall and which is represented by the rectangle *PRUS*.

The government suffers a loss of revenue due to the reduction of import duties equal to *QRUV*. On the other hand, however, it gains additional revenues of import taxes equal to *TYZV* owing to the expansion of imports.



GRAPH 2.—Representing the effects of the German tariff reduction on the German economy (for explanation see text).

Eventually, then, the tariff reduction causes the following profits and losses to the German economy:

(*a*) Loss of producers surplus	$-PSTQ$ (1)
(*b*) Loss of revenue due to reduction of import duties	$-QVUR$ (3)
(*c*) Increase of revenue due to the expansion of trade	$+TYZV$ (4)
(*d*) Gain to consumers (through fall of price-level)	$+PSUR$ (1 + 2 + 3)
Total net profit to the German economy	$TQV + TYZV$ (2 + 4)

Since $QV = VZ$, the area of $TQV + TYZV$ can be written as $1:5$ $TV \times QV$.

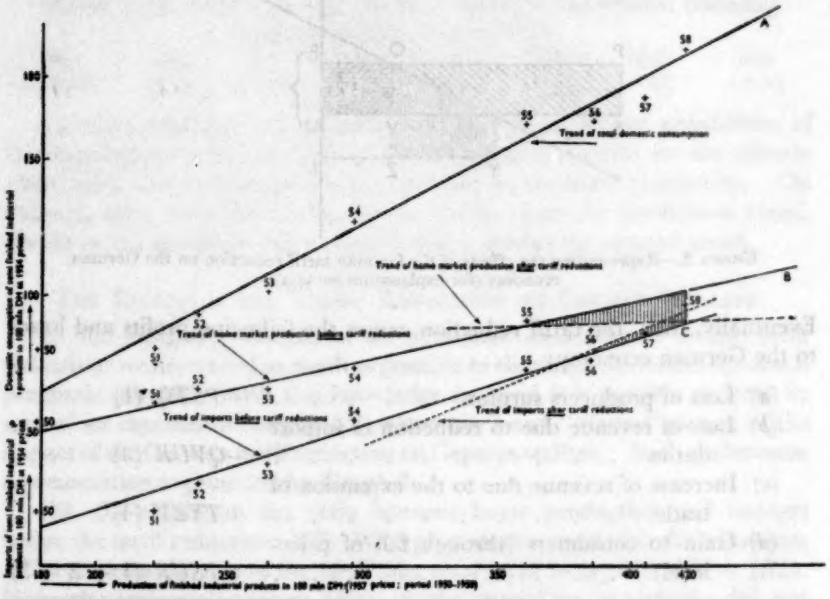
We know the extent of the " extra " rise in imports (*TV*). In terms of DM. of 1954 it amounts to DM. 2,500 million. The price fall (*RU*) being about 10%, the ultimate gain in prosperity amounts to $1\frac{1}{2} \times \frac{10}{100} \times$ DM. 2,500 million = DM. 375 million of 1954.

The rise in the national income resulting from the tariff reduction thus amounts to about DM. 375 million. This, compared with the national income in 1958 at roughly DM. 200,000 million (likewise in 1954 prices),

constitutes only 0·18% of that income. Even if we allow a very large margin of error which is necessary taking into consideration the extremely tentative character of our calculations, of 100% or more, this amount is so small that one is justified in concluding that for a country of the size of Germany import duties have no important impact on welfare, their significance being often grossly exaggerated, by text-books as well as by policy-makers.

The Reduction of Import Duties in the Semi-manufactures Sector

A similar graph as was given for the industrial end-products sector has been drawn up for the semi-finished manufactures sector (Graph 3). For


A
B
C
Trend of total domestic consumption
Trend of home market production after tariff reductions
Trend of home market production before tariff reductions
Trend of imports before tariff reductions
Trend of imports after tariff reductions

Graph 3.—Trends of consumption (*A*), home market production (*B*) and imports (*C*) of semi-finished manufactures.

this purpose, however, it seemed logical to assume that there is a certain relationship between the production of finished products and the total consumption of semi-manufactures.

In Graph 3 this relation has been indicated by the topmost straight line (*A*), which gives the trend between the production of finished products and the consumption of semi-manufactures in the period 1950–58.

The graph shows that there is indeed, as was to be expected, a high degree of correlation between the total output of industrial end-products

and the consumption of semi-manufactures (domestic production minus exports plus imports). This relation has not been affected by the tariff reduction.

It is interesting to know if a shift in the composition of the consumption of semi-manufactures has taken place after the cut in import duties in that more imported semi-manufactures (which are cheaper now) and fewer domestic semi-manufactures are bought.

As appears from the deviation of the line of domestic production after 1955 from the trend line in the graph, the domestic production of semi-manufactures declined relatively somewhat after the tariff reduction (see lines indicated by *B*). On the other hand, imports in this sector have shown a slight rise since 1955 (see lines indicated by *C*).

From these graphs and the pertinent figures on which they are based it might be inferred that, if the reduction of import duties on semi-manufactures has had any economic effect, it must have been considerably less than it had in the industrial end-products sector.

Since absolute reduction of import duties on semi-manufactures was lower than the reduction on finished products, this is not surprising in itself. Moreover, the effect of the fall in prices of semi-manufactures is normally very limited, since it is the demand for finished products which ultimately determines the demand for semi-finished products. Since we saw that apparently the consumption of finished industrial products was not substantially affected by the decline of import prices, the behaviour of the trendline indicating the consumption of semi-finished manufactures is not surprising.

Finally, the circumstance that the reaction of the import and production of semi-manufactures to the tariff reductions cannot be clearly traced, and is therefore probably limited, might also point to a small elasticity in the supply of semi-manufactures on the German home market.

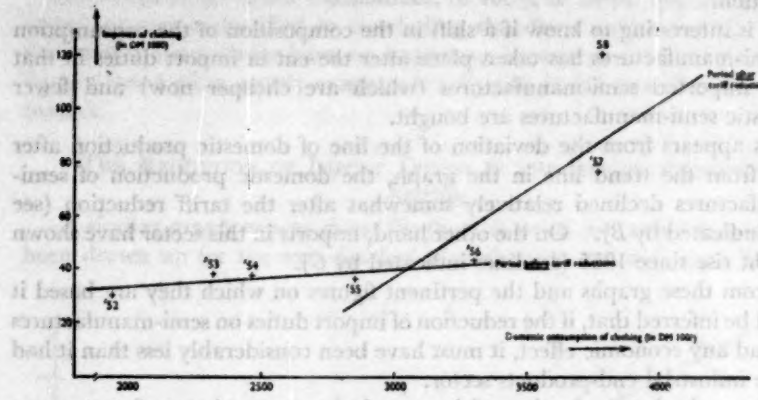
The Textile Industry—a Case Study

For the textile industry, as in every country in the world, a politically and psychologically important sector, separate graphs have been included. They are in agreement with the picture presented by total industry, and confirm the general conclusions already drawn.

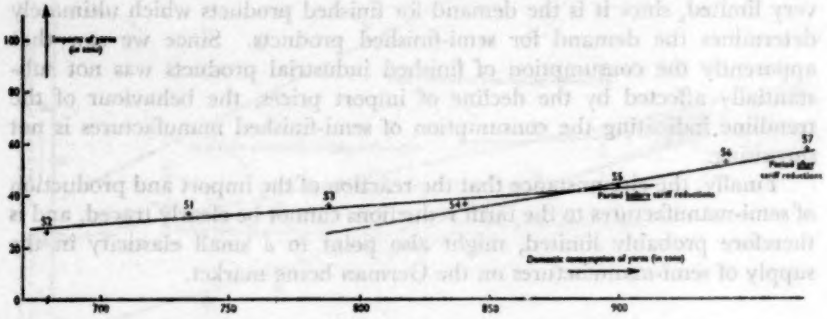
Graph 4 indicates the relation between the domestic consumption and imports of clothing in the period before the tariff reductions. This relation appears to be reasonably stable. After 1955, however, there is a strong deviation, because imports suddenly come to claim an ever larger share of the total consumption.

As to semi-manufactures (yarns), it appears from Graph 5—and we saw this also in general in the total sector of semi-manufactures—that the deviation from the " normal " development of the relation between imports and

domestic production after the tariff reductions is much less than it is in the case of the finished textile products.



GRAPH 4.—Correlation between imports and domestic consumption of clothing (ladies and gentlemen's outer and underwear) in DM. 1,000.



GRAPH 5.—Correlation between imports and domestic consumption of yarns, quantities in tons.

SUMMARY

(1) From the foregoing investigation it appears that it is reasonably possible to ascertain the effect (in so far as noticeable over a short period) of the German tariff reduction on the German economy. Notably the cut in import duties on industrial end-products appears to have had a highly stimulating effect on imports. The import elasticity has even been estimated at 8 or 10.

(2) From the figures it appears that the increase in imports as a result of the tariff reduction has probably been at the cost of the development of the domestic production (a large substitution effect) rather than the consequence of greater consumption.

(3) In reviewing the German tariff reduction it should be noted that it came about in the course of two years and amounted to more than 50% of the tariff applied. In spite of the forced character of this reduction the output of industrial end-products hardly showed a ripple, because the normal rate of growth, and particularly the greater export opportunities, offered sufficient compensation for the effects of the tariff reduction.

(4) It is certain, therefore, that, if this strong tariff impulse could already be coped with so smoothly, this will be even easier with a tariff reduction which, as has been envisaged, for instance, in the free-trade-area plans, (*a*) is spread over a longer period, or (*b*) is applied to a smaller number of countries.

(5) That in terms of welfare the part played by the tariff in the whole of the modern economic structure of a large industrial country is negligible is shown by the tentative calculation that was made of the effect of the German tariff reduction on the prosperity of the German economy. The short-term increase in the national income as a result of the cut in import duties was minimal.

(6) The cut in the import duties on semi-manufactures appears not to have caused any distinct large shifts. In all probability the economic effect has been small, in any case much smaller than it has been in the case of finished products. This may be accounted for, *inter alia*, by the lower duties in this sector.

(7) A case study of the development in such a politically and psychologically important sector as the textile industry confirmed—at least for this industry—the above findings made with respect to all industry.

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APPENDIX CONCERNING THE FIGURES USED

I. *Sources*

The figures are taken from the following publications:

1. *Imports/Exports*

Der Aussenhandel der Bundesrepublik Deutschland (1950–58) (Statistisches Bundesamt, Wiesbaden).

(*a*) *Teil 1: Zusammenfassende Uebersichten.*
(b) *Teil 2: Waren nach Herstellungsländern und Verbrauchsländern.*

2. *Production*

(a) *Die industrielle Produktion der Bundesrepublik* (1950–58) Deutschland, Reihe III.
(b) *Statistisches Jahrbuch der Bundesrepublik Deutschland* (1957 and 1958).
(c) *Wirtschaft und Statistik* (June 1958).

(d) *OEEC—Statistical Bulletin.* Definitions and methods concerning indices of industrial production (3rd edition, 1957).

(e) *OEEC—General Statistics* (July 1958).

3. *Tariffs*

Deutscher Gebrauchszolltarif; furthermore, *Austauschblätter* concerning changes in tariffs.

II. *Construction of the Indices*

1. The figures only apply to industrial products, since tariff reductions on agricultural products were small or zero.

2. With regard to semi-finished products and final products the figures were obtained by adding the following posts taken from:

(a) *Production Statistics:*

Semi-finished industrial products = " Produktionsgüter "
Finished industrial products = " Verbrauchsgüter + Investitionsgüter "

(b) *Imports/Exports Statistics*

Semi-finished industrial products = " Halbwaren + Vorerzeugnisse "
Finished industrial products = " Enderzeugnisse "

III. *How the Graphs Have Been Constructed*

Graphs 1 and 3

1. Production of semi-finished products and final products were calculated on the basis of the figures taken from I 2(*c*) with the aid of the weights of both groups in 1954 (sources I 2(*d*) and I 2(*b*)).

2. The figures for imports and exports composed as mentioned under II 2(*a*) were taken from *Aussenhandelsstatistik* (I 1(*a*)).

3. Domestic consumption was found by the formula:

Production + Imports − Exports.

The figures concerning national income were taken from: I 2(*e*)

4. All data were expressed in 1954 prices.

Graph 4

In this graph figures are given for a part of the important textiles sector. For this purpose the sector of clothing (Bekleidung) was chosen.

1. The figures on production are based on the items: 6411, 6412, 6421 and 6423 from German production statistics I 2(*a*).

2. The figures on imports and exports are based on the items 6101, 6102, 1603 and 6104, taken from *Aussenhandelsstatistik* (I 1(*b*)).

Graph 5

Yarns were chosen as an important example of semi-finished products in the textiles sector.

1. Data on production are based on the items 6331–6337 (I 2(*a*)).

2. Data on imports and exports are based on the items 50–57 taken from *Aussenhandelsstatistik* as mentioned under the head " zusammenfassende Uebersichten A—IIB—1—6 " (I 1(*a*)).

THE SOCIAL CHOICE BETWEEN HOME AND OVERSEAS INVESTMENT[1]

How much of its accruing saving should a country invest at home and how much, if anything, abroad? The question presumes that the relevant criteria for a country as a whole are not the same as those for individual investors—for if they were, the result of individual choices between home investment and capital export would coincide with the socially optimal investment distribution, and no separate question about national advantage could be asked. On the other hand, differences in the two sets of criteria, the social and the individual, raise issues of public policy including, in private-enterprise economies, government control (subsidy, tax or rationing) of private capital exports, and in State capitalist systems, some rationally based settlement of the competing political claims of domestic development and foreign lending or aid.

The present paper is concerned with a purely formal framework for analysing these issues. The first section examines prevalent arguments about the possible conflict between the individual and the social optimum, the second develops a formal theory of the social optimum allocation, while the third seeks to compare the result of private choices with this optimum.

It will be assumed throughout that private investors aim at maximising profit, while society would seek to maximise national income regardless of its distribution (on the ground that if it has taxing or rationing powers to bring about a certain investment combination, it also has powers to alter, if it wishes to, the domestic income distribution which would result from that combination). Society will be taken to be "selfish," *i.e.*, unconcerned about foreign real income except inasmuch as it has repercussions on its own income. It will also be assumed that the degree of domestic factor utilisation is the same regardless of the investment pattern (specifically, that employment is kept "full" whether domestic saving is taken out in the form of domestic capital formation or of a current-account balance-of-payments surplus).

I

The vulgar type of statement of the conflict between social and private optima in home and overseas investment asserts that while home investment augments the national income by an amount given by the capital–output ratio (some of the increase accruing to home profits and the rest to home wages), overseas investment raises it only by an amount given by the rate of profit abroad (the whole increase accruing to home profits). The equation

[1] For helpful comments on this article, and particularly for eliminating a *non sequitur* from Section III, I am indebted to Mr. J. Black. Any remaining errors are, of course, my own.

at the margin of the domestic and the foreign rate of profit involves a loss of national income equal to the share of wages in the extra domestic output which could have been secured by home investment, but was forgone in favour of income from capital exports. More concisely, home investment raises domestic, overseas investment raises foreign real wages.

The fallacy of this argument springs from the double confusion of an average with a marginal *and* of a statistical–historical with a *ceteris paribus* capital–output ratio. The marginal capital–output ratio, in the *ceteris paribus* sense of knowledge and other factor endowments (labour, land) remaining constant, is of course nothing but the reciprocal of the marginal physical productivity of capital. The corresponding capital-to-national-income ratio is the reciprocal of the marginal value-productivity of capital.

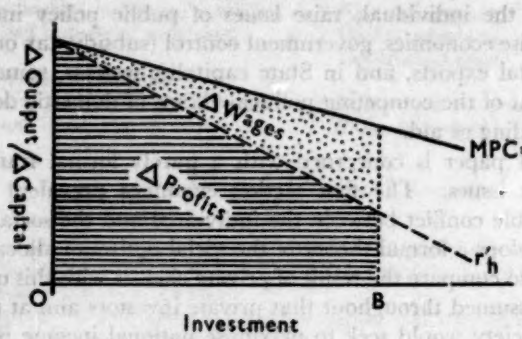

FIG. 1

The intellectually more respectable case against capital exports is based on this latter concept.

If factor rewards are equal to marginal value-products, the home and foreign rates of profit will be equal to the marginal value-productivities of capital at home and abroad respectively. Let these be denoted by r_h and r_f. Assuming that production functions are normal so that, with other factors held constant, the marginal value-productivity of capital falls as its stock is increased, r_h will decrease upon home and r_f upon foreign investment. The *prima facie* equilibrium combination of the two investment flows will be that which keeps r_h and r_f equal.

In Fig. 1 the y axis measures the marginal value-productivity of capital *MPC* in the home country, and the x axis the addition to its existing capital stock, *i.e.*, investment. An investment of OB increases national income by the area under the $MPC = r_h$ curve, of which the shaded area below the corresponding marginal curve r'_h accrues to profits and the dotted area above it to wages. Thus, for home investors taken together, the relevant reward is r'_h the marginal rate of profit. Similarly for the foreign profit rate r_f there is a corresponding marginal rate r'_f showing the addition to the total income

of investors abroad, while the difference between r_f and r'_f goes to foreign wages.

Part of total profit income abroad, however, accrues to the capital-exporting residents of the home country. If as yet they own none of the capital stock of the foreign country, they receive the profit rate r_f on their new overseas investment. If they already own all the existing capital overseas, they (taken together) merely receive r'_f. If they own some non-negligible share c of the overseas capital stock, their collective reward will accrue at some rate r_{fc}, where $r_f \geqslant r_{fc} \geqslant r'_f$.

There are hence two possible equilibrium solutions depending on whether investors in the home country behave in a perfectly competitive or in a monopolistic manner.

(*a*) In the former case each investor is looking at the profit rate he can earn on his own new investment and ignores the effect on his compatriots' old investments. He will merely compare r_h and r_f, and thus in equilibrium $r_h = r_f$. But since the home country as a whole is receiving r_h from home and r_{fc} from foreign investment, and since $r_{fc} < r_f$ when c is non-negligible, $r_{fc} < r_h$; while for the social optimum $r_{fc} = r_h$ is required. In other words, provided c is not zero, in the perfectly competitive case the equilibrium solution implies too much foreign and too little domestic investment.

(*b*) In the monopolistic case investors realise the effect of their investment choices on the yields of their already existing capital, and therefore equate r_{fc} and r'_h. The social optimum requires $r_{fc} = r_h$ as before, and since $r'_h < r_h$, the private equilibrium will again imply too much foreign and too little domestic investment.

In case (*a*) the private and social optima will diverge provided c, the proportion of capital in the foreign country owned by residents of the home country, is not negligibly small. In case (*b*), on the other hand, there will be a divergence even if $c = 0$ to start with, and *a fortiori* if $c > 0$. In both cases interference with private choices, by altering the allocation of a given volume of investment in favour of home investment, will result in a greater increment of national income than could be obtained from the private equilibrium allocation.

This, *in abstracto*, is the intellectual basis of the case against free capital exports. However, in the next section the requirement $r_h = r_{fc}$ will be shown to be a false criterion of the social optimum, and an alternative one will be deduced.

II

Implicit in the above argument is the condition that increases in the capital stock abroad must leave the marginal value-productivity of capital at home unaffected. However, this could strictly be so only in the special case of the closed economy. A closed economy, in turn, does not (and cannot) export capital, so that the question of conflict does not arise. If, on

the other hand, the home economy is an open one, the domestic value-productivity of capital will depend in some manner on the capital endowment of the rest of the world.[1] More precisely, the overseas capital stock will itself be a parameter of the function relating the domestic marginal value-productivity of capital to its domestic stock.

One way of augmenting the overseas capital stock is for the home country to export capital. A classic example of the effect on domestic marginal value-productivity is the case of the home country developing, by capital exports, foreign sources of raw materials. The benefit then clearly manifests itself in the home country's terms of trade. But comparative advantage works in more roundabout and subtle ways, too, which may connect mainly manufacturing, and not patently and obviously complementary, countries. The terms-of-trade effect may be disguised, taking the vaguer form of external economies. Long descriptive tracts could be written on this aspect alone; but perhaps it may suffice to remind ourselves at this juncture that "the division of labour [the scope for gains from trade] depends on the extent of the market."

At the same time no rigid one-way dependence should be assumed. While increased wealth abroad should, *ceteris paribus*, more often than not raise marginal value-productivity at home,[2] it may in certain circumstances

[1] The above functional dependence also suggests that the marginal value-productivity of capital abroad will in turn move with the capital endowment of the home country; but this will be ignored in the main text for the following reasons:

If the home capital stock grew without the foreign capital growing, the long-run terms of trade would change (normally worsen for the home country). The effect on the marginal value-productivities of capital in two areas of causing capital to be invested in one area rather than another (in our example, at home rather than abroad) can, in principle, be expressed as a change in the terms of trade compared to the terms of trade which would have obtained without the geographical reallocation of investment. *Reducing* foreign and *increasing* home investment by a given amount will imply a given percentage change in the long-run terms of trade between the home country and the rest of the world; and for small ranges, within which supply and demand functions can be treated as iso-elastic, *increasing* foreign and *reducing* home investment by the same given amount will imply the same percentage change of opposite sign in the terms of trade. Now if trade between the home country and the rest of the world absorbs a greater share of the national product of the former than of the latter—or, what comes to the same thing, if the home country is small—the effect will be relatively larger on the home country than on the rest of the world. This, admittedly, implies treating the rest of the world as a homogeneous entity, *i.e.*, one country. However, even if the effect of home investment on the rest of the world is of more than second-order importance compared to the effect of foreign investment on the home country, allowance can be made for it. Anticipating matters a little and turning to Fig. 2, successively higher foreign profit rate (r_f and r_{f_0}) curves can be drawn for successively greater volumes of home investment, and the relevant intersections with the home capital productivity curves correspondingly lifted. However, not much would be gained by introducing this refinement in the main analysis. Therefore it is conducted as if there were only one effect, namely, that of the foreign capital stock on home productivity, and no effect of the home capital stock on foreign productivity.

[2] In treating this as the more "likely" or important case, the present article may appear to challenge the notion that the more similar are factor endowments in two countries, the lesser are the potential gains from trade between them. If we express the latter in terms of the value-productivity of capital in the capital-exporting country A, the *MPC* curve in Fig. 2 ought therefore to be shifting downwards with increases in the capital stock in B, rather than upwards as it is doing —the presumption being that A is the capital intensive country, and its capital exports are making

have adverse terms-of-trade effects or result in external diseconomies; perhaps more improbably, beneficial and adverse effects may exactly balance, by accident satisfying the closed-economy condition underlying the argument summarised in Section I that the domestic marginal value-productivity of capital is independent of the foreign capital stock. Circumstances may well be allowed to alter cases, but not a formal apparatus designed to cover them all. The apparatus of this section is presented in terms of a positive and perceptible beneficial effect of a growing overseas capital endowment on domestic capital productivity. However, as will be observed, it can, *mutatis mutandis*, be turned to the analysis of other types of case also.

The diagram (Fig. 2), is drawn on the assumption that there is OQ of investible resources (annual saving from a full-employment income) to be allocated between home and overseas investment in such a way as to maximise the resulting domestic "growth" (increment in the home country's national income). MPC_o is the domestic marginal value-productivity of capital *given* the overseas capital stock. If, however, the latter were increased by an amount QE_x, the former would shift upward to MPC_x. This, of course, means that by devoting capital QE_x to foreign rather than domestic investment, the home country could cause the marginal value-productivity of the capital OE_x (remaining for home investment) to rise from MPC_o to MPC_x,[1] and so on for successively larger capital exports until, with the export of all available capital QO, the home marginal productivity reaches OZ. For want of specific information to the contrary, the MPC curves are assumed to be linear and to shift vertically without change of slope upon an increase in the foreign capital stock, their height being some linear function of it.

With the whole available capital allocated to home investment, the increment of national income would (as in Section I) be the area under MPC_o from O to Q. With capital exports of QO, some very high value-productivity Z would be reached, but no capital would be left over for home investment to take advantage of it. Neglecting, for the moment, profit

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B capital-intensive, too. However, no such challenge is intended. For it is, of course, known that the gains from trade need only fall as factor ratios become more similar if the production functions in A and B are similar. But even if this were the case (which is improbable wherever natural resources are important and dissimilar), and the gains from trade were becoming smaller as factor ratios in the two countries moved nearer to each other, this would still leave out of account the income effect of *increasing the factor endowment* of B at any given *factor ratio*. Putting it crudely, while the change in B's factor ratio *may* shift B's production pattern from exports to import-substitutes, the increase in its total factor endowment *will* increase its total production and its total domestic absorption of both exportables and imports. There is thus still room for A to gain if B's production of exportables increases more than its domestic demand for them, and if its demand for imports increases more than its production of import-substitutes. The weight of historical evidence seems overwhelmingly to be on the side of this being the likelier outcome.

[1] Readers will have noted a remote analogy with the optimum-tariff argument, with restriction of home investment (and expansion of overseas investment) standing for the export tax or import duty. The principal difference is that while the optimum-tariff argument relies on movements *along* supply and demand curves, the theory of capital exports developed here derives a somewhat similar effect from movements *of* supply and demand curves.

income from overseas investment, here is a simple maximum problem: the task is to choose an MPC_x curve between MPC_o and Z so as to maximise the area under it, given the condition that the higher the (selected) MPC_x curve, the greater must have been the capital exports needed to reach that height, and therefore the lesser the capital remaining for home investment. The problem is not unlike that of maximising total revenue: the higher the

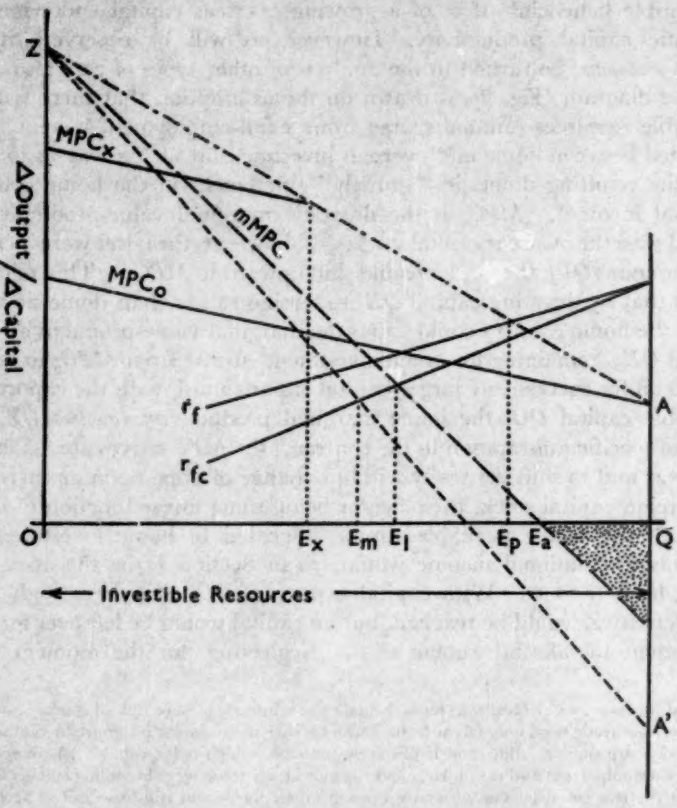

FIG. 2

price, the smaller must have been sales, total revenue reaching its maximum where marginal revenue falls to zero.

" Marginal revenue " in this context is the increase of the area under successively lower *MPC* curves as home investment is " expanded " and capital exports " reduced " by moving from left to right in Fig. 2. Assuming that this movement (the fall of the share of overseas investment in total investment OQ) can proceed in perfectly divisible steps, there will be in-

finitely many *MPC* curves between *Z* and MPC_0. The locus of their right-hand ends will be the envelope *ZA*. Its corresponding marginal curve is *mMPC* (as it were, the "marginal" marginal value-productivity of home investment with respect to overseas investment). It bisects every possible *MPC* curve, as the area under it must at every point be identical with the area under the particular *MPC* curve which could be reached by selecting the ratio of home to overseas investment represented by the abscissa of that particular point.

Since *mMPC* reaches zero at E_a, OE_a is the optimum share of home and QE_a that of overseas investment which it would pay the home country to undertake even if it received no direct return on the latter, so that QE_a practically represents foreign *aid* granted; the subscript *a* in E_a is to suggest this.

Now we can introduce the profit rate on overseas investments. It is represented by the curve r_f, which, of course, slopes from right to left, falling as foreign investment increases; r_{fc} and r'_f can be derived from it along the lines of Section I. The socially relevant rate is r_{fc}; as drawn, it intersects *mMPC* at E_l, and thus QE_l will be the optimum share of accumulation devoted to foreign *lending*. Not unexpectedly, optimum *lending* (QE_l) is greater than optimum *aid* (QE_a); this confirms the common-sense conclusion that the more willing the receiving country was to service its external indebtedness and/or allow the repatriation of profits from foreign-owned investments, the more foreign capital it would get.

If, however, the capital-importing country were a discriminating monopsonist of capital, it should first refuse to pay interest or profits, since the exporting country should, in its own interest, still be anxious to grant it development aid equal to QE_a.[1] After successful negotiation of the aid, it should liberalise capital imports and guarantee the repatriation of profits, thereby inducing further foreign investment of E_aE_l.

III

This formal apparatus can now be applied to adjudicate on the supposed conflict between the social and private optimum allocation. The argument summarised in Section I alleged that the private allocation must almost invariably lead to more capital exports than is good for the home economy; the one exception being when, in case (*a*) (perfect competition among

[1] There is an even more sinister implication here. If *ZA* was inelastic enough for *mMPC* to intersect the *x* axis between *O* and *Q*, refusal of the foreign country to *accept* development aid would involve the home country in a loss (forgone increment) of national income equal to the dotted triangle under the *x* axis in Fig. 2. The foreign country could thus exact an annual tribute from the home country in exchange for its consent to accept development aid, and spend the tribute on arms, palaces or means of princely conveyance; for as long as the tribute demanded fell short of the amount represented by the triangle, the home country would still be better off than if investment equal to the base of the triangle failed to take place in the foreign country.

investors), the home country does not as yet own more than a negligible fraction of the overseas capital stock. However, in Section II it was shown that the social optimum is satisfied not by $r_h = r_{fc}$ as the prevalent arguments seem to hold, but by $mMPC = r_{fc}$. Will private choice tend to diverge from this equality, and if so, in which direction?

For any point along the x axis (*i.e.*, for any volume of capital exports), r_h is higher than *mMPC* so long as *ZA* runs above *mMPC*, *i.e.*, so long as more development overseas could lift the marginal value-productivity of home capital. *ZA* is the locus of successively lower marginal productivities consistent with successively smaller capital exports; hence it is also the locus of the various possible home profit rates r_h earned by the domestic investor.

Perfectly competitive private investment choice will seek to equate r_h to r_f. The particular r_h (out of the multitude of various possible ones) capable of becoming equal to r_f is that found at the intersection of *ZA* and r_f. Clearly, $ZA = r_f$ need not coincide with $mMPC = r_{fc}$. There *may* therefore be a conflict between social and private choice. However, it is difficult to detect any obvious tendency to divergence one way or the other; for while $ZA > mMPC$ suggests that private capital exports will be too small, $r_f > r_{fc}$ suggests that they will be too large. Any divergence either way between the competitive private (QE_p) and the social (QE_l) optimum can result only from a net balance of these two offsetting biases.

If, on the other hand, the choice between home and foreign investment were made by a monopolist who owned all the already existing home and foreign investments, his aim would be to equate the marginal addition to his home and to his foreign profits. The latter is shown by the area under the r_{fc} curve, and thus coincides with the socially relevant criterion. The former, however, diverges from what is relevant for society. For society the return from home investment is the area under *mMPC*; but this area includes *both* the profits of new investment *and* the amount by which the new investment reduces profits on old investments and increases real wages.

For the monopolist (though not for society, which includes wage-earners) the transfer of this amount from profits to wages is a loss which he deducts from the total area under *mMPC* to arrive at the net addition to his total home profits. This addition is represented by the *ZA'* curve in Fig. 2, the area under which is, at every abscissa, equal to the *rectangle* under the particular *MPC* curve consistent with the proportion between home and foreign investment shown by the abscissa in question. The difference between *mMPC* and *ZA'* is that the former shows the change of the whole area under a shifting *MPC* curve, while the latter shows the change of the area of the rectangle under the same shifting *MPC* curve. Since *MPC* slopes downward, the area of a rectangle under it is everywhere smaller than the whole area under it; therefore *ZA'* must everywhere lie below *mMPC*. This, in turn, means that *ZA'* must intersect with r_{fc} further to the left (at E_m) than *mMPC* (at E_l), so that a perfect monopolist would, to

maximise profit, invest less at home and more abroad than is required to maximise total national income.

Fortunately, this is a too fanciful case to warrant concern; for while it could be true, particularly in the case of direct overseas investment, which is often the preserve of a few larger firms, that capital is being exported from a country by a monopolist or quasi-monopolist, it is most unlikely that the home country's capital stock should also be largely owned by the same monopolist.

Save this last contingency, one can draw a relatively complacent conclusion in favour of letting private investment decisions take their course. A conflict between private and social investment optima is entirely possible; what appears impossible is to *establish the presumption of a general bias* for private overseas investment to be either too large or too small. Nor can therefore a general recommendation be made for public policy in this regard. If there is a case for stimulation or obstruction of overseas investment it can only be established by a quantitative study of the specific instance on hand—a study which, even if feasible, is bound to be exceedingly complicated and full of sources of potential error.

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PRODUCTION FUNCTIONS AND LAND—A NEW APPROACH

WHEN Jevons and others established the general principle that the price of a factor of production is equal to its marginal yield it was tempting to generalise the result in a single formula applicable to all factors. Just as the adjustment of the price of a consumable product to its marginal utility could be regarded as maximising utility, so the adjustment of the price of a factor of production to its marginal productivity could be regarded as maximising production.

Jevons described his theory of economics as "purely mathematical in character." "Believing," he wrote, "that the quantities with which we deal must be subject to continuous variation, I do not hesitate to use the appropriate branch of mathematical science, involving though it does the fearless consideration of infinitely small quantities. The theory consists in applying the differential calculus to the familiar notions of wealth, utility, value, demand, supply, capital, interest, labour."

The use of the calculus is an aid to clear thinking in economics. Yet the assumption of continuity is one to be made with caution.

A differential coefficient is a limit: $\frac{dy}{dx}$ is the limit which the ratio of an increment of y to an increment of x approaches when the increments are made indefinitely small. But nothing in human motives ever does become indefinitely small.

In a static treatment of economics, however, a function is composed of a series of hypotheses, and the interval between one hypothesis and another is not subject to the same limitations as human motives. When we plot a demand curve or an indifference curve for an individual consumer we want to show how his consumption of a commodity would react to various possible alternative assumptions. Actually the price is p, and he buys x per unit of time; had the price at the present time been q, he would have bought y. The schedule is a set of hypotheses about his present disposition. If we were considering the effect of a change of price we should limit ourselves to a change of such magnitude as to affect the consumer's behaviour, and we should take account of the impact of a change on his outlook. But a static theory is concerned not with changes but with hypothetically different static conditions, and allows an indefinitely small difference between one hypothesis and the next. The schedule therefore can properly be represented by a continuous function or curve.

A demand function adds up the demands of all the consumers. It may be conceived as composed of a number of terms, each term covering a group of consumers whose motives are sufficiently similar to one another to form

a significant average. A price which is reckoned high in one group is thought moderate in another and trifling in a third. And the relation of the commodity to other consumable things may be different in different groups. Each group contributes a trend or governing tendency, and the function is the resultant of all the trends, any fortuitous and irrelevant disturbances being assumed to be averaged out within each group. When we depart from the statical treatment, and investigate a change of conditions, we find that at a subsequent date the function itself will have changed. We have a new set of hypotheses, which may or may not closely resemble the old. And we cannot assume a continuous transition from the old set to the new. The hypotheses relate to human motives, in which there are apt to be discontinuous changes of mind.

A production function purports to express the output of a producing unit or group of units as a mathematical function of the factors employed. Since it relates output to costs, the product and the factors must alike be priced. With given prices under perfect competition, the producer aims at maximising the excess of the value of output over costs.

If the respective amounts of the three fundamental factors, labour, capital and land, used in an output, P, are a, b and c, and their prices are p, q and r, the cost of production is $pa + qb + cr$.

If P is a continuous function of a, b and c, the conditions of $P - pa - qb - rc$ being a maximum are

$$\frac{\partial P}{\partial a} - p = 0, \quad \frac{\partial P}{\partial b} - q = 0, \quad \frac{\partial P}{\partial c} - r = 0$$ [1]

Economists who concentrate on the mathematical calculations have been prone to accept this result rather uncritically. In particular, they have been ready to assume that the condition relating to land can be interpreted in the same way as those relating to labour and capital.

The terms pa and qb, representing labour and capital in the formula for costs, are composed of a units of labour and b units of capital (valued at their cost in the market). But land has no cost. To the producer who buys or leases land the rental value is, of course, part of his costs. As Marshall said, " land is but a particular form of capital from the point of view of the individual manufacturer or cultivator." The landowner exacts a rent equal to the saving of cost, but to him there is no cost.

Different pieces of capital equipment, like different pieces of land, have widely different cost-saving efficacy. But plant and tools of high cost-saving efficacy do not command a correspondingly high price, because they can be supplied in response to demand at prices corresponding to the cost of producing them. The supply of land of any specified cost-saving efficacy is limited. The owner who makes his land available is participating like the capitalist in the process of production, but at no cost to himself. If

[1] See Edgeworth, *Papers*, Vol. I, p. 20.

a piece of capital equipment is sub-marginal, in that its cost-saving efficacy is below zero, it is not demanded, and is not produced: the cost of producing it is saved. If a piece of land is submarginal it is not used, but no cost is saved.

The producer who is calculating how much capital to employ with a given amount of labour and land will see the limit at the point at which the cost-saving efficacy of any additional plant ceases to cover the cost of the plant. That is why the price and the cost-saving efficacy of any factor tend to be equal. But the cost of land is zero, so that the landowner offers land of any cost-saving efficacy, however low, to producers for what it will fetch; only marginal and sub-marginal land are unused and fetch nothing.

Any land of which the rent asked by the owner is appreciably below its rental value would be sought after by producers who could make an extra profit by using it. So under static conditions the rent charged by a landowner is deemed to be equal to the rental value.

The symmetry of the production function $P - pa - qb - rc$ is misleading; the prices, p and q, of labour and capital are equal to the marginal yields of labour and capital, but r, the price of land, is not " marginal " at all. The price of each piece of land is its *total* cost-saving efficacy. The price of a marginal piece of land is zero.

A producer who is already using labour, capital and land in suitable proportions, and who wants to employ some additional labour and capital has the choice of working his existing land more intensively or acquiring additional land. Additional land may be marginal land, hitherto yielding no rent, or it may be supra-marginal land diverted from some other use. For supra-marginal land he must pay rent, so that it will be no more profitable to him than marginal land.

Producers all producing one commodity, who constitute an industry, are in the same position as the single producer. Additional land brought into use by the industry is either marginal land or rent-yielding land diverted from other uses. For all industries taken together, composing the entire production of the community, additional land brought into use can only be land previously marginal and sub-marginal. It comes into use because the increase in cost consequent on the more intensive use of the land already occupied gives it a competitive advantage which brings it into the rent-earning class.[1]

The intensive marginal yield of land and the extensive marginal yield are both zero: the latter because marginal land yields no rent; the former because the intensive exploitation of a piece of land is pushed to the limit beyond which any further expenditure on labour and capital will not be covered by the additional output obtained.

[1] There may, of course, be other changes which bring land into the rent-earning class, but there is no need to enter into these.

In the formula for cost, $pa + qb + rc$, the prices p and q are equated to the marginal yields of labour and capital. If r, being the marginal yield of land, is zero, the symmetry is destroyed.

When the formula is applied to a particular industry the cost, it is true, does include an item for land, the rent paid by the producers to the landowners. But this item is no parallel of the items for labour and capital. The expression of these latter as products of quantity and price presupposes units of quantity. The quantity of a factor composed, like capital, of heterogeneous units is measured in terms of money at actual or hypothetical prices. In the case of capital the various items find their common basis of measurement in their market prices, which correspond under static conditions to their costs of production (along with the rate of interest), but for land this common basis is lacking.

All the same, it may be said, a piece of land has a price, and all that is needed to give significance to the item rc in the expression for cost is a unit of land. Why not area? Land is priced at so much the acre or so much the square foot.

But area has not the same kind of economic significance as cost of production. It is not dealt with in the market as a separate entity and cannot have a market price actual or hypothetical. Where land is to be used as the source of primary products derived from the stuff of the land itself (the soil, or mineral deposits) area may be thought of as in some degree an indicator of the quantity of stuff to be obtained. But it can only be a very vague indicator of the quantity, and mere quantity cannot be priced apart from the essential considerations of ease or difficulty of working, and of location and access. At the time, after the First World War, when Germany's capacity to pay reparations was under discussion, an enthusiast argued that Germany had coal reserves amounting to hundreds of thousands of millions of tons which, valued at 10*s*. a ton at the pit's mouth, would amount to more than £50,000 million.

And what quantitative measure can there be of sites which are not used for the production of crops or minerals, but are valued for their situation for houses or for industrial or commercial business or for transport facilities? Each plot of land is unique in its characteristics; plots have not the interchangeability which makes items of plant and capital equipment legitimately measurable in terms of price.

The price of a piece of land under static conditions is its rental value, its total cost-saving efficacy. Then, it may be asked, is not a unit of cost-saving efficacy just the unit of quantity that we are looking for? Unfortunately that will not do. We can equate the price of labour or capital to its marginal cost-saving efficacy, because the total cost-saving efficacy of the quantity of labour or capital employed is not identical with its quantity. If we define the quantity of land as its total cost-saving efficacy the concept of its marginal efficacy becomes nugatory.

But even if we could find a suitable unit which would make land quantitatively measurable we still should not be able to put land on the same footing as capital and labour. The producer would not make the calculations which, in the cases of capital and labour, lead up to the equality of price and marginal yield. For when he procures an additional piece of land he has to pay a rent which just cancels its differential advantages. If we imagine him reckoning how much land to use with a given force of labour and capital, and adding on successive hypothetical increments of land, the price of an increment of land is irrelevant. Whether the land is high-priced or low-priced does not matter to him. He pays the landlord the value of the cost-saving efficacy of the land, and for the land, apart from that characteristic, he pays what he would have to pay for marginal land, that is, nothing.

When he is reckoning the effect of successive increments of capital he arranges them in order of cost-saving efficacy. Some items are literally indispensable; some less essential still have an enormous cost-saving efficacy relative to their price; others are of gradually descending efficacy, down to the marginal items, which only just save the equivalent of their own cost. We may suppose his hypothetical capital outlay to increase continuously, and the total cost-saving efficacy of a specified capital outlay to be expressed as a function of the latter. The function exhibits a trend, in virtue of which there is a significant differential coefficient in respect of the capital outlay, by which the marginal cost-saving efficacy can be defined.

Successive increments of land do not exhibit any such trend. Their prices are purely fortuitous; the price of any increment bears no relation to that of the increment before or to that of the increment after. The net cost-saving efficacy of all is reduced to zero by the rents paid. There is no trend, and there can be no differential coefficient.

In the cost expression, $pa + qb + rc$, the last term must drop out. The curtailed expression $pa + qb$ is the cost of factors other than land. The excess of the output, P, of an industry over this cost is the total rent, R, paid to landowners (or a constructive rent, where the producer is himself the landowner.) The total rent, R, cannot be analysed significantly into a quantity, c, of land and a price, r, and we cannot get from it a differential coefficient or a marginal yield.

The true cost of the output is $pa + qb$, the third term, R, representing so much of the cost as is spared through the efficacy of the land.

Does this amendment give us a rehabilitated production function? There are, I think, still certain objections to it.

When we identify the marginal efficacy of labour and capital with the partial differential coefficients $\frac{\partial P}{\partial a}$ and $\frac{\partial P}{\partial b}$ we are assuming that a and b are independent variables.

Production consists of a series of processes in each of which labour and

capital may both be employed. If the proportion of capital to labour is altered, that usually means that in one of these processes some mechanical device which saves labour has been introduced (or abandoned). A variation in the proportions in which factors are employed therefore means that one factor is substituted for another, so that the factors are not independent. If a and b are not independent variables they cannot form partial differential coefficients, $\frac{\partial P}{\partial a}$ and $\frac{\partial P}{\partial b}$.

We may restate the producer's aim as the production of a specified output at a minimum cost. The cost depends on the relative amounts of the factors employed and their prices. The partial differential coefficients presuppose that any variation in a factor can be directly related to a consequent variation in output, independently of the other factors. But that is not so, for variations in factors affect output through their effect on total cost, that is to say, on one another.

Suppose that the total labour-saving efficacy of capital employed to the amount of b is f. Then the efficacy of the labour employed to the amount of a, plus capital, b, expressed in units of labour, is $a + f$. If the producer's aim is to minimise the cost of a specified output the total efficacy will be a constant, e, corresponding to this output. Since a is equal to $e - f$, the cost is $p(e - f) + qb$.

If f is a continuous function of b the condition that the cost be a minimum is $p\frac{df}{db} = q$. That is, the marginal efficacy of capital must be equal to the price of capital relative to the price of labour.

This calculation applies to an entire industry no less than to a single producer. And it applies equally to the total production of a community, for, as the formula relates one factor to another, and does not depend on the end product for which they are employed, the difficulty of aggregating heterogeneous products does not arise.[1]

In applying it to the total production we can no longer treat the prices of labour and capital as given. Prices have to be adapted to the marginal-efficacy formula. If at any moment they are inconsistent with it, there will be a disparity between the demand for a factor and its supply. Changes of price will result, and each new price structure will call for a new adjustment of marginal efficacies. A static theory assumes that perfect adjustment will be attained. To make prices as well as quantities variable in the formula would make the mathematics more complicated without any compensating advantage.

In the expression $p(e - f) + qb$ the total efficacy, e, is the amount of labour which would be required to produce the specified output on the extreme hypothesis that the capital employed, b, is zero. As is often the

[1] The pricing of a factor, such as labour or capital, does raise the problem of aggregating heterogeneous quantities. But that pricing is presupposed in any form of production function.

case in economic functions, the extreme hypothesis can be ignored. Whatever e or f may be, the difference $e - f$ is a definite quantity, the amount of labour employed, and the differential coefficient, $\frac{df}{db}$, does not depend on the absolute magnitude of f.

We might have made f the total efficacy of labour, a, instead of that of capital. We should then have had an expression for costs, $q(e - f) + pa$, in which e would have meant the amount of capital required to produce the specified output without the aid of labour—a hypothesis not merely extreme but absurd, for if there is no labour nothing is done.

The formula embraces only two factors. Having discarded land, it treats all labour and all capital each as one factor. But it can be extended to a multiplicity of factors. We may distinguish long-term capital, for instance, from working capital, each having its appropriate rate of interest. And management, instead of being merged in labour, can be treated as a separate cost-saving service, earning remuneration equivalent to its marginal efficacy.

Suppose that, in addition to labour, there are three factors, b_1, b_2 and b_3, that their respective prices are q_1, q_2 and q_3, and that their total cost-saving efficacies are f_1, f_2 and f_3. The cost-saving efficacy of any factor will be a function of that factor alone, to the exclusion of the others. But cost saved by a factor will not be limited to costs of labour, but may include costs of other factors.

$$\begin{aligned} \text{Total efficacy} \quad & = a + f_1 + f_2 + f_3 = e \\ \text{Cost} \quad & = pa + q_1b_1 + q_2b_2 + q_3b_3 \\ & = pe - (pf_1 - q_1b_1) - (pf_2 - q_2b_2) - (pf_3 - q_3b_3) \end{aligned}$$

The conditions of cost being a minimum are:

$$p\frac{df_1}{db_1} - q_1 + \left(p\frac{df_2}{db_2} - q_2\right)\frac{db_2}{db_1} + \left(p\frac{df_3}{db_3} - q_3\right)\frac{db_3}{db_1} = 0$$

$$\left(p\frac{df_1}{db_1} - q_1\right)\frac{db_1}{db_2} + p\frac{df_2}{db_2} - q_2 + \left(p\frac{df_3}{db_3} - q_3\right)\frac{db_3}{db_2} = 0$$

$$\left(p\frac{df_1}{db_1} - q_1\right)\frac{db_1}{db_3} + \left(p\frac{df_2}{db_2} - q_2\right)\frac{db_2}{db_3} + p\frac{df_3}{db_3} - q_3 = 0$$

These are satisfied by making:

$$p\frac{df_1}{db_1} = q_1 \quad p\frac{df_2}{db_2} = q_2 \quad p\frac{df_3}{db_3} = q_3$$

So the formula which equates the marginal efficacy of a factor to its price applies to the case of a multiplicity of factors.

The formula applies only to factors of production which can be substituted for one another. A special skill which is indispensable for the

production of a particular commodity, and is used for no other purpose, is sometimes classed as a separate factor of production. In the case of a single producer or all the producers of a particular industry, the formula gives the conditions of minimum cost with given prices of factors. If the price of a special skill is assumed to be given, there is no problem of minimum cost, for the cost is the given price. The formula gives the cost of the material to which the special skill is to be applied, and the cost of applying it is simply the assumed price of the skill.

When the formula is extended to the aggregate production of the community the prices of the special skills come into the process of adjustment, which leads up to the equilibrium position. The price of a special skill is reflected in the price of the article in the production of which the special skill is employed, and equilibrium requires a price structure in which the demand for the article is just sufficient to allow full employment to the special skill.

The relative prices of the fundamental factors of production, labour, capital and management (we are leaving land on one side for the moment) are determined by their marginal cost-saving efficacies. The prices of end products come into the calculations only because the price level of factors has to be so adjusted to the price level of end products as to maintain normal profit margins and full employment.

The possessors of a special skill, on the other hand, in deciding what rate of remuneration to demand, have to take into account the effect on the sales of the end products. In this respect their position approximates to that of an *enterprise*, which takes the responsibility for supplying an end product, and relies on selling it to make a profit.

And there are other objections to treating a special skill as a separate factor. No clear boundary line can be drawn between special skills and the aptitudes which are merged in the main body of labour. Skills which are employed in several distinct end products, but cannot be used for any other purpose, are subject to the same considerations as those which specialise in one product. But where they extend to many end products, they become indistinguishable from the kind of skill which is used in all industries. Indeed, we can hardly suppose that there are particular skills which are used literally in all industries. Skills can be learnt, and the recruit to industry who hopes to qualify as skilled can choose which trade to learn. And even in middle life a worker can change from one occupation to another, at the cost of wasting a part of his acquired aptitudes.

Management is in a sense only a branch of labour. Like other kinds of labour, it commands a price corresponding to its marginal efficacy. And individuals with the requisite qualifications, natural or acquired, for management are recruited from the main body of labour. They range from high-paid executives down to foremen and others employed on direct supervision and discipline. Nevertheless, it is useful, certainly in some

connections, to treat management as a factor. It is specifically directed to the function of cost-saving, and takes its place quite naturally in our formula, though it differs from other factors in that its cost-saving efficacy can be regarded as directly increasing output.

The formula $p\frac{df}{db} = q$ presupposes that the successive values of the efficacy f corresponding to the values of b can be suitably represented by a continuous function. Where b represents management, that is a legitimate assumption. We may suppose expenditure on management to be so nicely calculated that every additional shilling (whether in numbers employed, in rates of remuneration or in incidental expenses) will bring its yield in increased output or decreased cost. As in the demand function, we are dealing with hypotheses of human behaviour.

But where b represents capital, the successive values, being dictated by technological consideration, will be, in general, essentially discontinuous. The value of f corresponding to a value of b is composed of all those technical devices which have an efficacy above the margin determined by q in relation to other prices. They are not related together in any other way. The marginal efficacy is a mathematical fiction, designed to correspond with the gap between the efficacy of a device just on the margin and the next largest efficacy or the next smallest. Neither gap has any significance, and they may differ to an indefinite extent in size.

When we apply the formula to a large number of producers, composing an entire industry, there is some semblance of continuity. The producers are not to be supposed all to adopt a labour-saving device simultaneously. Marginal or nearly marginal devices will be adopted only by some of the producers, so that b, the total capital employed in the industry, can be supposed to vary by very small hypothetical steps. But it is still true that the differential coefficient, $\frac{df}{db}$, has no economic significance. The simple fact that producers will adopt those pieces of plant which will save costs not less than the costs of interest, depreciation and maintenance which they involve is easy to understand without resort to a mathematical hypothesis.

Expression of an economic quantity as a mathematical function is not in general useful unless there is an underlying trend which will give reality to its differential coefficients of first, second and higher orders. Our production function $p(e - f) + qb$ is not committed by its form to be a continuous function. If $p(e - f) + qb$ is to be the minimum cost, then $pf - qb$ must be greater than any alternative $pf' - qb'$. That is, $\frac{f - f'}{b - b'}$ must be greater than $\frac{q}{p}$.

If we can devise a continuous function, f, which corresponds sufficiently closely to successive increments of capital employed, placed in order of

efficacy, the expression $\frac{f-f'}{b-b'}$ approaches the limit $\frac{df}{db}$. But this only restates through a mathematical analogy a principle which we can quite well understand without any mathematics.

How are be to deal with land? The rental value of a piece of land, being its total cost-saving efficacy, reckoned in terms of costs of other factors, is in no sense a marginal quantity. The rent derived from a piece of land is, on the assumptions of static conditions, the highest cost-saving efficacy that can be realised from it in any employment. When, as is usual, an industry employs some land which could earn rent, but at lower rates, in other industries, it is increasing the costs of these latter by withholding it from them. When there is a piece of land which has the same rental value for two different industries it may be called marginal in a special sense. But the rental value may be high or low.

Land, as we have seen, is not measurable in terms of any quantitative unit of economic significance. How, then, can we say that its price is high or low? The rental value counts as high when the land's cost-saving efficacy is a high proportion of the value of the output derived from it.

It is a mistake to say that the rental value of land is exclusively due to its natural endowments. It often depends vitally on the degree and character of man-made developments of neighbouring land, especially on the distribution of population, and on the transport and communications giving access to markets and materials.

Moreover, fixed capital in the form of improvements and structures sunk in the land becomes inseparable from it, so that the value attributable to it is merged in the land value. Likewise any causes of loss of value, such as soil erosion or depletion of minerals. Land on which there has been capital outlay in the past is valued in the market as if this capital outlay were a natural endowment. The price of the land does not include a recoupment of the outlay itself, but reflects the cost-saving efficacy of the capital under current conditions. A site cumbered with obsolete and worn-out structures may still command a rent in excess of its bare land value. Only when this excess disappears is it worth while to demolish the structures and to appropriate the site to some new venture.

Static theory makes the producer pay the landowner the full cost-saving efficacy of the land he uses. Is not this a paradox? How can he make anything out of the land for himself?

Land, like the other factors, is an indispensable means of production. Its cost-saving efficacy determines its price, because it relates the land to the other factors, the prices of which go to make up costs. But the price does not pretend to measure the productive virtue of the factor. Marginal land commands no price, but it is available for use, and when used makes its contribution to the productive process. It commands no price, not because of any technical failing, but because it has to face the competition

of other land more favourably endowed. The basic productive services of marginal land may be compared to those of a free water supply, or of light and air. Rent is paid for advantages additional to the basic services.

A formula relating only to costs disregards profit. Profit is the remuneration of enterprise, that is to say, of the decision to produce. The producer engages in his enterprise with a view to the sale of his product. He believes that there is a demand to be satisfied. A condition of success is that he must keep down costs. If he incurs higher costs than his competitors, his margin of profit will be diminished or perhaps extinguished. If he reduces his costs below theirs, his margin of profit will be so much the greater, and he may be able to extend his sales at the expense of theirs.

But the keeping down of costs is only ancillary to his essential function, that of deciding what is to be produced. What is produced is destined to be sold, and it is the selling which yields profit, and rewards the producer. The landowner, the capitalist and the worker are all engaged by the producer to contribute to the productive process. But the landowner's function approximates to that of the producer himself. The capitalist holds his resources in the form of money for disposal in the investment market; the worker sells his services at a price determined by the labour market. But the landowner bears the responsibility of deciding to what use his particular piece of land is to be put. He may accept the offer of the first comer, who will use the land in a way yielding but a fraction of its potential efficacy, but, if he does, he is not acting according to static theory. Static theory assumes him to select the use in which the potential efficacy of the land is fully realised. That selection is essentially different from the sale of services in the labour market or the placing of capital in the investment market; it shares with enterprise the decision what things are to be produced.

The production function excludes enterprise from the factors of production, and the profits of enterprise from the prices of factors. That may be defended on the ground that enterprise is not a cost; its decisions are not a time-taking function, such as can be paid for by a salary. And landowning is similar in this respect to enterprise. The landowner is remunerated for decisions.

My formula for the function of production is a formula for costs, which legitimately excludes land as well as enterprise. Land, however, is universally classed as a factor of production. And it would seem that enterprise should also be so classed.

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REVIEWS

Business Enterprise: its Growth and Organisation. By R. S. Edwards and H. Townsend. (London: Macmillan, 1958. Pp. xvii + 706. 60*s*.)

For over ten years the authors of this book have held a seminar on problems of industrial administration at the London School of Economics, at which industrialists and others present papers on the organisation and problems of their particular enterprises. It was the existence of this collection of case material which prompted the writing of the book. Although nine of the seminar papers are given in full in appendices (and extremely interesting they are), while others provide many illustrations, the book is much more than a collection of seminar papers and discussions. The authors have drawn on a wide range of knowledge and experience to give a large-scale survey of the structure and problems of industry, with a central theme of exploration of the factors which influence business enterprise and thereby economic growth and development.

The book is divided into four Parts. The first, entitled "Variety of Industry," deals with such matters as the birth and growth of firms, the different forms of organisation, the relevance of science and the "patchwork of specialisation." Part Two is devoted to the integration of industrial activities; a discussion of economies of scale and the merits of large organisations leads to a three-fold classification of methods of integration—by administration, through the market and by co-operation in various forms. The third Part, "The Government and Industry," is the longest, and deals with various topics: the organisation and finance of industrial research (a matter in which Professor Edwards' previous work is deservedly well-known), the establishment of common services, controls over production, industrial location and (in four chapters) the nationalised industries. Part Four is a short discussion of the future of British industry, with emphasis on the factors influencing the rate of innovation.

The general conclusions can best be summarised in their own words:

> "First, the patterns of industrial organisation are bewilderingly complex and it would be a matter for concern if they were not. Secondly, no assumptions should be made or action taken that would imply a bias in favour of either large or small scale. Thirdly, the State should, in general, avoid action and prevent action that would bring about rigidities in the industrial structure. The most important requirement of industrial organisation is that it should provide for variety and change" (p. 573).

It is impossible in a short review to do justice to the wealth of material on which they draw to establish and illuminate these (and other less far-reaching) generalisations. Different readers will no doubt find different parts of

the book the most stimulating and informative. I would pick out the first Part as of particular interest, though it is matched by some of the individual chapters (such as that on economies of scale), while the group of chapters on nationalised industries would be hard to beat as a succinct statement of the issues. Other parts, such as accounts of governmental controls and collective organisations, are less interesting, though allowance must be made for the nature of the material as well as for a reviewer's greater familiarity with certain of the matters covered.

As the authors point out in the preface, in this field empirical studies have lagged behind theory; and, while they are clear that theory is not much use without a basis of empirical verification, make only modest claims for their own achievement: the instances which they provide " need adding to many times over before we shall have more than a cursory knowledge of the working of industry and trade. We need to find out much more about the actual operations of firms and industries before very confident conclusions are drawn about any of the big issues." Although it can be agreed that much more empirical work needs to be done, I think that the implication of the authors' emphasis on the variety of industry, that generalisation is extremely hazardous, perhaps even impossible, can be somewhat exaggerated; I at least should be surprised if many of their conclusions and judgments were to be seriously upset by the accumulation of further evidence.

They are equally cautious in warning the reader that he must allow for their own predilections, especially in Part Three: " We have tried to show in the text where description and analysis end and advocacy begins, but it would be disingenuous to pretend that even the description and analysis can be completely freed from convictions." It would indeed be idle so to pretend, even though some writers make the attempt; from the *Wealth of Nations* onwards, all great works on economics have sprung from some system of consistent ideas, and their value is by no means lessened thereby. It is often too easily forgotten that an accusation that an analysis has been inspired by particular convictions about what is true and important is completely irrelevant to its validity and to the value of the evidence which it presents. The fact that this book is to some extent a tract for the times does not reduce the significance either of its analysis or its value as a standard work of reference. The authors state that they hope that the book " will prove useful not only to those who study industrial economics for professional and academic examinations but also to practising businessmen." It will certainly have an important place in University reading lists, for the best up-to-date account of such matters as economies of scale in the firm, the problems of the nationalised industries or government policy on location of industry, while many business-men would undoubtedly gain from its perusal, if only to learn that they have been talking prose without knowing it. It is, however, more than a text-book; it is also an original work which must have an important influence on the approach to many aspects of economic organisa-

tion and growth. It is to be hoped that Professor Edwards' translation to the administration of one of the nationalised industries will not preclude a further instalment of the authors' analysis of the nature and operations of enterprise.

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Income and Economic Welfare. By S. G. STURMEY. (London: Longmans, 1959. Pp. x + 208. 21*s.*)

LEST the title of this book mislead any economist to suppose that this is a book about welfare economics, it will be said at the start that it is an elementary textbook about economic institutions. The excuse for using the word welfare in the title is, apparently, the author's opinion that " economic welfare " (". . . only a part of total welfare " or " happiness ") is commensurate with real income, about which there is sytematic discussion in these pages. But about welfare economics, as understood in the profession, there is nothing other than an occasional use of the word optimum, or equilibrium, and allusions in several places (pp. 5, 167, 202) to the effect that a maximum position is reached when the additional gains to welfare no longer exceed the additional losses. And though this may beguile the eager beginner into the belief that he is being presented with a principle of universal application since—like the formula " the greatest happiness of the greatest number "—it carries with it the echo of revelation, no light is shed on the problems of welfare economics by continual affirmation that, whatever economic welfare is, it reaches a maximum at an upper turning point.

While, in general, it is expected that the enthusiasm of the reviewer fall short of that of the publisher, the discrepancy of opinion in this instance extends as much to the author's intentions as to his achievements. We are told on the dust cover that " The first two sections of the book cover the meaning of economic welfare and its relation to the total welfare of the community, the connection between income and economic welfare, the theory of income determination and the causes of both unemployment and inflation." If the connection between income and economic welfare is disclosed by such statements as, first, that the more real income a person has the more economic welfare he enjoys and, second, that a unit increase in income will cause a greater increase in economic welfare if it accrues to a person with a low income than if it accrues to a person with a high income, then, indeed, the author can be held to have established the connection. As for providing a theory of income determination, apart from a paragraph on page 42, too condensed to be of much use to the beginner, it is just not to be found. There is a single reference to the multiplier on page 55,

where it is described as "a reasonably stable relationship between the eventual increase in income which will flow from any primary increase and that primary increase," but no more. And while there are some definitions and some informal discussion of inflation and unemployment, to claim that the book covers "the causes of both unemployment and inflation" is surely stretching publisher's licence beyond the elastic limit.

In so elementary and placid a treatment of the subject there is virtually nothing to take issue with, and it remains only to indicate the subject matter of the book. The first three chapters amount to a rather diluted version of Hicks' *Social Framework*. The first chapter equates economic welfare with real income, elaborates the definition of income in terms of a flow of goods and services, distinguishes between real and money income, and classifies sources of income. The second chapter discusses the size, age-structure and trend of the population, while the third chapter on production and expenditure makes use of data from the blue book to illustrate the necessary relations between national income, national production, and national expenditure. Chapter 4 discusses such factors as the level of employment, inflation, productivity, and investment, which influence changes in money and real income. Chapter 5 is devoted to the nature and measurement of unemployment. Chapter 6 begins by discussing the forms in which income is received and passes on to a brief history of trade unions and some remarks on the existing negotiating machinery in the determination of wages. The role and functions of trade unions are briefly surveyed in Chapter 7. The effect on the distribution of real income of the continuous rise in the price-level since 1939 is discussed and illustrated with blue book figures in Chapter 8. Chapter 9, on the development of the modern welfare state, undertakes some impressive comparisons between the bad old days before the turn of the century and the ubiquitous beneficence of the modern government agency. Chapter 10 on housing turns out to be a convincing indictment of rent controls. The book ends with Chapter 11 on the effect of taxes on the redistribution of income, and the extent of growth and changes in the composition of output over time.

On the whole, then, if one is willing to impute only a modest ambition in the author there is little to quarrel with in the treatment of the topics he has decided to cover. Here and there, however, there are traces of carelessness. On page 157, for instance, we meet with the statement, "To raise the present pension to a level at which no retired people would be in need would . . . have inflationary consequences." This is obviously a *non sequitur*. Regardless of how need is defined, unless we are told how government expenditure on pensions is to be financed we can make no predictions about its monetary effects. Again, to be told, at the beginning of Chapter 3, that national income is identical with national expenditure, apparently on the grounds that income generates expenditure, is not likely to convey to the reader the nature of identities. The conscientious but

innocent student is almost sure to find himself stuck a few pages later. He will read (on page 45) that the value added by each enterprise is the difference between the value of sales and the cost of materials and services, excluding wages, bought from other sectors of the economy, and—" alternatively " according to Mr. Sturmey—as wages and salaries paid by an enterprise plus profit (or minus loss). The first definition, which might be better framed as the value of all sales less all " outside " purchases (whether materials or services), however, amounts to wages, salaries, profits, *and* depreciation. The second—unless " profits " is to be interpreted as gross revenue—does *not* include depreciation and, in fact, in a closed economy, amounts to net national income. When, therefore, the reader is told that the sum of values added (and " payments for services ") *is* the gross domestic product, he may guess that the author intended to say that it was *equal in value* to the gross domestic product. If he has already read *The Social Framework*, or Edey and Peacock's *National Income and Social Accounting*, he may even guess that it is the first definition of value added which applies in this connection. But it is more likely he will read it several times and then give up. In particular as, at the bottom of the page, pretty much the same confusion occurs. The sum of the factor incomes is said to be equal to gross domestic product (which it is not, on the generally accepted definitions), and that gross domestic product is equal to national income " before making allowance for capital consumption." The harassed reader is finally assured that gross domestic product *is* the same as national income and capital consumption " because they are exactly the same thing looked at in slightly different ways." And that, apparently, clinches it.

As affording some background material for sixth formers or first year students this book, which is for the most part clearly written, will have its uses as a source book to be glanced through prior to seeking more systematic analysis and more specialised data.

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La Répartition du Revenu National. By JEAN MARCHAL and JACQUES LECAILLON. Part I: Les Participants: Vol. I, Les Salariés; Vol. II, Les Entrepreneurs, Agriculteurs, Prêteurs, Bénéficiaries de Transferts. (Paris: Librairie de Médicis, 1958. Vol. I: pp. 667; Fr. 36; Vol. II: pp. 388; Fr. 24.)

PROFESSOR JEAN MARCHAL of Paris and Professor Jacques Lecaillon of Lille have published a first instalment of their monumental study of the distribution of national income. As is explained in their general introduction, the authors aim to present a new theory of the distribution of national income. They believe that neither the classical, nor the neo-classical, nor the marxist

theory is able to explain the actual facts of the distribution of national income. They advance the view that a general theory of the distribution of national income cannot be conceived, since the latter is heavily influenced by institutional, political and sociological factors. The two authors deliberately confine themselves to the elaboration of a theory of the distribution of national income in developed countries. That means that the distribution of national income in underdeveloped countries and in countries behind the Iron Curtain is not to be explained by the theories the authors will present in the second part of their study. I am myself convinced that the prevailing body of economic theory has to be enlarged or at the least modified in order to explain economic tendencies in underdeveloped countries. I have started work along these lines during the last four years. The work of Professors Marchal and Lecaillon is similarly concerned to secure a closer reconcilation of economic theory with reality. They started some thirty years earlier.

The first Part of the work gives only a few hints of the theory to be presented in the second Part. These hints may be confirmed by reading some of the articles published by Professor Marchal in the *Revue Economique*, in the *American Economic Review* and in the *Economia Internazionale* during the years 1950–54. He has there argued that the distribution of national income is influenced by the struggle between the various social classes and between individuals therein.

In this first Part the authors make a valuable analysis of data concerning the distribution of income in France, in the United States and in the United Kingdom. They then proceed to their analysis in order to define the groups that participate in the distribution of national income in these three countries on the basis of the latest data. The institutional, political and sociological factors which influence the distribution of national income are considered in detail.

The authors stress the consequences of the diminished importance of the entrepreneur now and compared with the nineteenth century; of the appearance of organised pressure groups; of the oligopolistic markets of to-day; of the Government's and of the central bank's intervention in the money and in the capital markets. They conclude after a careful analysis that they have all contributed to an increased possibility of excess of purchasing power compared with the goods available.

The first volume includes, following a general introduction and a preliminary chapter, five other chapters dealing with the incomes of salary and wage earners. The authors believe that national income is best regarded as distributed between five groups: salary and wage earners, industrial and commercial firms, farmers, lenders of capital (both real and monetary) and the beneficiaries of transfer payments who offer nothing immediately. Among their more interesting conclusions are: that, while the percentage of female workers increases, those who get senior posts remains small; that wage and salary earners seldom own property; that the income of farmers

is lower than that of industrial workers and others outside the agricultural sector; that the increase in numbers of those employed in the tertiary sector is balanced by the increase of productivity in the secondary sector; that salary and wage earners constitute the majority of the active population.

The authors further insist on the disappearance of the former differences between those working in agriculture and in industry. They explain it by the tendency of the former to adapt themselves to the conditions prevailing in industry. They draw attention also to the growing importance of incomes accruing to salary and wage earners not in respect of their productivity but of the number of their dependants, particularly in the case of the lower-paid workers; to the special position and interests of higher employees, whom they call "*cadres*," in both the private and nationalised sectors; to the greater percentage of skilled workers and foremen in big firms; to the tendency to assess people on the basis of real income. They reach the conclusion that the wage and salary earners for the purpose of the study of the distribution of the national income should be defined as those employees paid on a monthly basis; and in addition the higher-placed employees who, owing to their higher education and to their participation in the decision-making, are, however, in a special position. The French term "*cadres*" has no real equivalent in English. These comments and groupings seem to be wholly justified, not only by the admirable treatment of the authors but also in the light of my own general experience. It remains to be seen how, in the second part of the work, the theoretical analysis will be developed to handle these concepts.

In the second volume, divided into four sections, the remaining income earners—all others, that is, than salary and wage earners—are dealt with. The authors stress the fact that entrepreneurs constitute a minority but, despite public control and nationalisation, enjoy valuable monopolistic advantages. These are absent in the case of those who lend real or nominal capital. To the latter the authors assimilate the owners of rented houses. The house-owners are chiefly concerned to preserve their capital and only to a less extent with the rent. The authors make in this connection an excellent analysis of the considerations which induce investments and loans under abnormal monetary conditions. Capitalists rely very seldom on their incomes. The ability and desire to protect their incomes is not the basis of their satisfactions. They also handle successfully the problems posed by the attempts of farmers to transfer to the nation the consequences of the instability of the markets of their products. Transfer payments are also justified on the basis of the desire to secure a certain minimum to everybody. Thus the authors identify seven further groups of participants in the national income: commercial and industrial entrepreneurs; private and nationalised undertakings; the latter's managers; those working on their own account; farmers; lenders; the beneficiaries of transfer payments.

As I said earlier, we must wait for the full theoretical analysis before we

can properly appraise this work. I may, however, already draw attention to the excellence of the preliminary analysis contained in these volumes and express my own agreement with the authors' view that it is not possible to have a general theory of distribution. Economic theory becomes thus more complex but nearer to reality. Let me add that the first volumes here reviewed remind the reader of what the historic school ought to have performed if it was to achieve its objective of presenting a body of theory based on reality.

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Toward a Geography of Price: A Study in Geo-econometrics. By WILLIAM WARNTZ. (Philadelphia: University of Pennsylvania Press (London: Oxford University Press), 1959. Pp. 117. 40*s.*)

THE main aim of this study is, in its own words, " to develop the theory of space potential and demonstrate its usefulness as a type of methodology in economic geography." " *Space* potential " is here opposed to what is termed " *time* potential," with which the book also deals. Two main kinds of space potential systems are studied, namely: population potential and supply potential. The word " potential " in all this is being used in a sense analogous to that encountered in electrical contexts. Thus any concentration of population is thought of as exerting at all points, near and far, an influence which varies directly with the size of the population and inversely with the distance from it. This influence (called population potential by John Q. Stewart, Professor of Astronomical Physics at Princeton University, who originated the concept) is expressed numerically by means of the simple formula P/d, where P is the size of the population, and d is the distance from it. The total population potential *at any point* can then be evaluated, in principle, by aggregating these quotients as calculated for all population centres, near and far, according to their respective distances from it.

Dr. Warntz has made estimates along these lines for the central points of all the states of the United States. He has weighted the population figures used according to the local average income per head. The resulting values he has called Gross Economic Population Potential (1940–49 average). He has presented these values on a map, using a system of contour lines joining points of equal potential.

" Supply space potential " for any particular product is calculated on exactly similar lines, except that the annual rate of production at any point is used in place of population figures. Dr. Warntz has estimated, for the United States in 1940–49, supply space potential figures for wheat, potatoes, onions and strawberries respectively. Supply time potentials are also calculated, for the same four products—this constituting an analogous method of allowing for the time pattern, as opposed to the geographical pattern, of production.

Dr. Warntz goes on to formulate an hypothesis that the price (of a particular product, at a particular place and time) varies directly with " gross economic population potential," and inversely with both supply space potential and supply time potential. He then carries out a test of this hypothesis, in the form of four multiple correlation calculations (one for each of the products). In these calculations, price, as the dependent variable, is investigated for multiple correlation with the three " potential " indices. Relationships harmonious with the hypothesis are found to exist, and the levels of significance involved, in the technical statistical sense, are high.

Thus the structure of the book, like its aim, is extremely straightforward, and it is based upon a monumental foundation of arithmetic. The misgivings it arouses are correspondingly straightforward and fundamental.

For example, there is a complete lack of discussion of any theoretical basis for expecting an expression of the form P/d to describe the influence upon price of a population P at a distance d. One cannot be satisfied with having this influence left mysterious, like a kind of gravitational field, when it must arise out of the processes of buying, selling and transporting, which are not mysterious, although they are subtle and complex. On the face of it, an expression of the form, say, $\lambda P - \mu d + \nu$ would seem at least as easy to relate to these elementary processes. There is a special difficulty with Dr. Warntz's formula when $d = 0$, and it looks as though he has solved this in an anomalous manner (putting $d = 1$ instead) which makes the relative importance of local and distant populations depend in a highly arbitrary manner upon the distance unit chosen. One is similarly worried about Dr. Warntz's time discounting formula. It leads to different results from those of time-discounting methods in common use, and these *have* a theoretical basis.

In view of the nature of these doubts, another one arises as to whether Dr. Warntz's hypothesis is sufficiently stringent for its statistical vindication to have much bearing upon the validity of the basic concepts which he wants to establish as fundamentals of economic thought. After all, one would expect any indices epitomising proximity to markets or to sources of supply to be strongly correlated, in appropriate senses, with prices. Incidentally, it would be interesting to see the geographical pattern, if any, in the algebraic sign of the deviations of " actual " from " expected " prices.

Despite misgivings of this kind, and despite a slight embarrassment caused by Dr. Warntz's terminological abandon, the fact remains that it is refreshing to encounter a good and imaginative idea expounded with enthusiasm. Very much more pioneering work clearly still has to be done in this field. Those inclined to participate in this would probably find Dr. Warntz's book interesting and stimulating.

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Factor Endowments and International Trade. A statement and appraisal of the Heckscher–Ohlin theory. By SUBIMAL MOOKERJEE. (Bombay: Asia Publishing House for the Indian School of International Studies, 1958. Pp. viii + 99. 20*s*.)

THIS book presents a neat and elegant exposition of the theory that holds international trade to be the result of differences in relative factor endowments. Dr. Mookerjee employs the formidable set of geometrical devices (developed recently by Lancaster, Rybczynski and others) that owe their existence to the debate on international factor prices, started by Samuelson and Lerner. The diagrams have been clarified and arranged logically, additions have been made, and the different parts of the analysis are connected by a sternly concise commentary which, if very Euclidean in places, certainly tackles economic problems. There is a brief but useful bibliography of recent articles.

But Dr. Mookerjee is at least as interested in the " appraisal " of the Heckscher–Ohlin theory as in its exposition; his central chapter is entitled " Verification of the Heckscher–Ohlin Theorem." The author is not, in this chapter, concerned with attempts at empirical verification (or falsification) *à la* Leontief (although on that question he has some conventional but convincing passages in Chapter V), but rather with the internal consistency of the model. His main interest here is in the inherent implausibility of assuming the possibility of an " unequivocal definition of factor intensity ": a commodity which is labour-intensive at one set of prices may be capital-intensive at another. In Chapter IV we are shown the now familiar proof that such lack of consistency in factor intensity can remove any stimuli to factor-price equalisation, but elsewhere the author stresses a relatively neglected point—the dependence of the whole Ohlin-type model on the existence of immutable factor intensities. If there are no labour-intensive commodities, labour-abundant countries cannot export them! We are left with a severely truncated theory, which states merely that if countries have differences in relative factor endowment, and these differences are not offset by others, then there is likely to be some profitable trade: " In general, however, no definite *a priori* generalisation concerning the composition of trade is possible " (p. 95); differences in factor proportions need not impart a systematic bias to production.

This is Dr. Mookerjee's most revolutionary point. He is very helpful elsewhere: on technicalities (for example, in Section 3.3, on conditions for complete and partial specialisation); on the generalisation of his analysis to the many-goods, many-factor case (although on this question his discussions in Sections 4.2 and 4.5 seem to confuse the real world with the model, and to make concealed empirical assumptions); and on the Leontief controversy. On only two other issues can one question his treatment. First, he constantly reiterates a distinction between a model based on differences in relative *quantities* of factors and one based on differences in factor *prices*

(before trade); but market demand conditions have to be introduced anyway (as Dr. Mookerjee recognises), and hence the two approaches coincide. Here he would seem to confuse the method of solution with the solution itself—a fault (if so it be) no doubt encouraged by the preoccupation with techniques necessary in writing such a book. Secondly, and more trivially, Fig. 18, the heavy gun against factor-price equalisation, is not as clearly explained as are the others, and in Section 4.1 a slight (and purely verbal) confusion between dynamics and comparative statics clouds the issue.

However, the only possible strong criticism of this book would be that "appraisal" runs a very bad second to "statement." Dr. Mookerjee mentions with approval Dr. R. Robinson's important criticism of the Ohlin doctrine in the *Quarterly Journal of Economics* (May and August 1956); he joins issue (p. 86, footnote) with those who argue that the restrictive (and arbitrary) assumptions of the Ohlin-type model are a virtue; and he is aware of the dual difficulty of using "capital" as a factor of production—the specificity of physical capital and the possibility of trade in capital goods. Of course, a real appraisal would demand an empirical, not a theoretical, work, and Dr. Mookerjee carefully avoids casual empiricism. But there is room at least for the formulation and examination of alternative hypotheses (increasing returns, differences in production conditions, specific resources, dynamic causes and the like). Moreover, many of these problems (on which the author touches in his last chapter) bear on the internal consistency of the Heckscher–Ohlin model itself.

Consider three issues of assorted importance. First, on p. 14 Dr. Mookerjee notes that the assumption of constant returns to scale implies that "the number of firms producing the commodity concerned remains undetermined." At the end of his book he discusses product differentiation as a possible cause of trade *sui generis* (p. 93). But surely constant returns to scale (if they applied in the real world) would lead to product differentiation —hence product homogencity is an unlikely (though necessary) ornament of the Heckscher–Ohlin model. Secondly, the model is not just part of the theory of markets—it purports to explain the establishment of trading patterns through time. If we recognise (p. 91) the importance of capital movements, what reason is there to believe that adjustment to relative factor abundances will outpace factor movements? And thirdly, should we not be wary (although Dr. Mookerjee does not emphasise this point of Samuelson) of extending the Ohlin-type analysis to trade in manufactures or exotics merely by multiplying the number of factors? And if we do not adopt this course, what other explanation of trade in manufactures does the model offer us?

Despite Dr. Mookerjee's relegaion of these important problems to his last few pages, the body of his work will be a valuable addition to the research student's and teacher's library.

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Cambridge.

Economic Arithmetic. By R. L. MARRIS. (London: Macmillan, 1958. Pp. xvii + 349. 28*s*.)

MR. MARRIS defines Economic Arithmetic as a considerably wider subject than economic statistics. He points out that in economics not only is there considerable scope for the tools of statistical method but also there arise problems in the handling and presentation of statistical material. Since we can only describe the economic system quantitatively through statistics, there are many problems of definition, measurement and processing which are not covered in the usual text-books on statistical analysis. Surely, however, economic statistics has this wider connotation for which Mr. Marris feels the need to borrow the term arithmetic. If the author had written about the descriptive side only and had omitted method altogether a new term and title might have been appropriate, but, in fact, he includes sections on regression analysis and time-series and the like. So the title tends somewhat to arouse expectations which are only partly realised.

The book, which is intended primarily for second- and third-year students, is divided into three parts. The first is largely an extensive description of British national income concepts and statistics. National income and capital is, of course, undoubtedly the most important branch of "sources" and one which the student must master. But it is by no means easy. The accounts which appear in many text-books do not help a great deal either. Mr. Marris' chapters dispel some of the fog, but doubts still remain. It is hard to be convinced of the helpfulness of describing money flows in hydraulic terms with the aid of quite complicated diagrams. Why not use some of the actual figures as pegs on which to hang the argument? It is rather remarkable that Mr. Marris succeeds in discussing national income almost without the use of a single statistic. Some of the difficulty, too, almost certainly derives from the attempt, usually, to be comprehensive and realistic. The National Income Blue Book has essentially to be detailed, complex and complete, but the essentials of national income analysis can be explained much more easily through a greatly simplified model.

The second part of *Economic Arithmetic* claims to discuss the intellectual foundations of two important statistical techniques: regression and time-series analysis. Here the words intellectual foundations appear to be something of an exaggeration. There is no consideration of fundamentals and little enlightenment for the student as to what he is really assuming and doing when he follows a guide book in carrying out a particular analysis. Just one minor example of this is seen when Mr. Marris states that "a moving average trend, not being wedded to any particular hypothesis about the nature of the trend . . ." (p. 146). Again, in the chapter on associated movements in variables there appears to be a good deal of confusion between a structural law and a regression line. It seems dangerous to introduce the concept of regression through the idea of "a regular law relating the two

variables" (p. 156). Indeed, the arrangement of this chapter leaves a lot to be desired. Throughout the bulk of it the student is misled to believe that in calculating one regression line he is estimating the underlying law, and then almost at the end (p. 179) he is suddenly confronted with the other regression line. Finally, in the penultimate paragraph a hint is given, but not elaborated, that the whole topic of estimating the parameters of a *law* in the economic system is much more complicated.

In fact, it does seem that there is no middle course in this business of discussing such topics as regression analysis. Either the techniques are bluntly described with due warnings about snags and difficulties in rather the way elementary mathematics is taught in the lower school or else, if one wishes to go further, the fundamental theory, involving stochastic concepts, statistical inference, and the like, has to be mastered. Looked at from this point of view, the choice of techniques by Mr. Marris leaves him in a difficult situation. Study of association among economic variables raises (or should raise) most formidable problems, of estimation and the like, which are generally solvable but only usually with quite a mathematical battery. Mr. Marris touches on this (p. 180), but why refer to the topic as "the method of simultaneous equations" which has a connotation in algebra with no probabilistic implication or content at all? With time-series analysis it is not even possible to say that the problems are yet solvable. The underlying theory here rests in a most primitive and unpromising state.

The third part of the book, covering almost half the total length, is devoted to index-numbers; first, their general properties, then their application to measurement of changes in family real income and to changes in real national product. The discussion ranges widely, well beyond the confines of pure index-number theory. There is an interesting account of the conceptual problems of measuring real income and real output and full treatment of the associated philosophical difficulties. It seems a little forbidding to introduce welfare considerations right at the outset, but perhaps it is logical so to do. It is in Part III that much of Mr. Marris' original work is to be found, and it is informative to read of Buscheguennce's important but neglected theorem linking the Fisher ideal index with indifference-curve theory. The third section of the book in many ways forms the most stimulating reading, but it does seem, in places, to lack rigour. So much depends on the shape of the indifference-curve system about which we know nothing and which is rarely described in precise terms. It grates a little to read (p. 247) "if the indifference curves are well and evenly rounded and of a certain symmetrical pattern . . ." Or, again, (p. 259) ". . . . any number which lies somewhere between the values of the Laspeyres and Paasche results . . . will normally come closer to the theoretical 'true' index . . . than will either the Paasche or Laspeyres index taken alone." Why this should be asserted is difficult to see. 72 lies between 70 and 90 but is not nearer to 85 (say) than is 90.

To summarise, the book forms most absorbing reading, is full of ideas and will well repay the, by no means light, task of perusal in detail from cover to cover. Yet whether it quite achieves its object or whether it is quite the finished work which might have been expected seems open to doubt.

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The Control of the Purse. By P. EINZIG. (London: Secker & Warburg, 1959. Pp. 344. 35*s.*)

AFTER a period of years in which relatively little attention was paid to the processes of Parliamentary financial control, there has recently been an outpouring of ideas from a number of quarters. Professor Beer's *Treasury Control*, Sir Herbert Brittain's *The British Budgetary System* and now Dr. Einzig's book all belong to the same family. The subject, bordering as it does on constitutional, administrative and economic matters, has always potentially had a wide appeal. Now it is in the limelight.

Dr. Einzig is concerned with the broad sweep of history and with one fundamental theme: how Parliament evolved over the centuries a finely tempered system of financial control, how this system reached near perfection in the golden age before 1914 and how much it has deteriorated since then. The result is a lively book with a great deal of material, much of it otherwise inaccessible, attractively presented. The three parts dealing respectively with the early days, the period from 1688 to 1850, and the years since then are of approximately equal length. The historical aspects do therefore predominate and form an essential background to the assessment of the position in modern times. Nevertheless, it is the latter which is likely to be of most interest to most economists.

There can be no denying the supreme importance of effective Parliamentary control over expenditure. It also seems likely that this control is less effective than it was some 50–75 years ago. To give one illustration only, it is now over 35 years since Parliament made any changes in the Estimates laid before it by the Executive. Perhaps this diminution of Parliamentary interest and control has not been as much as Dr. Einzig would have us believe, but it would be hard to deny that there has been some diminution. But having said this, what can be done about it? It is here that Dr. Einzig's treatment is unsatisfactory. He realises that there is a fundamental difficulty that if the responsibilities of modern government are greater and more complex, the exercise of effective control is much harder. But he never really makes it clear whether he thinks that the role of government ought to be much less or whether he thinks that more effective control can be exercised even if the present range of functions is given. He gives the impression of always being too busy grinding his axe to ask himself what exactly he wants to cut down with it.

There are a number of other ways in which the book is open to criticism. The reasoning is far from tight, for example the assertion (p. 331) that without government retrenchment the country is doomed to inflation. One would have thought that reference to methods of control in other countries such as the United States would have been an essential feature of the argument; but there is no mention of them. So although *The Control of the Purse* is an interesting and lively book, it can hardly be said to have been written in a spirit of academic detachment or to face the basic issues utterly fairly and utterly squarely.

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An International Trade in Managerial Skills. By J. S. FFORDE. (Oxford: Blackwell, 1957. Pp. 153. 18*s.* 6*d.*)

THE subject matter of this book is of considerable contemporary interest. With the growth and spread of private international investment, on the one hand, and the interest shown by governments of advanced nations in the economic development of those less advanced on the other, the traffic in industrial and commercial knowledge between countries has risen steeply. Sometimes such knowledge has been accompanied by a migration of labour; sometimes by that of capital. The motives behind this flow have been manifold—political, strategic and humanitarian, as well as economic.

What are the main types of knowledge which are capable of being transmitted from one country to another? By what means are they made available? How is the appropriate route chosen? What are the chief social and political problems likely to be encountered in the assimilation of such knowledge into a foreign environment and how best may they be overcome?

These are the sort of questions which Mr. Fforde seeks to answer in his book within the context of the flow of managerial and technical skills from the United Kingdom to some of the underdeveloped countries. In so doing, he outlines four main channels by which such knowledge may be transmitted—the direct recruitment of British labour by the particular country in question; the joint venture between a British and a local company —which may or may not involve a financial commitment on the part of the United Kingdom, and which may be short or long term in character; the product-specialised manufacturing enterprise controlled from the United Kingdom and without the assistance of any local participation; and the trader-industrialist or agency house, a non-manufacturing enterprise whose activities are confined to the provision of services of one kind or another. The problems of initiating and operating such ventures, and their likely success, are analysed in the light of the five main variables determining the choice of route: the actual or desired degree of local control, the length of time of the proposed association, the nature of the products to be

manufactured, the complexity of the production process and the size of the local enterprise.

The finer points of the choice determinants and their implications for the United Kingdom are discussed at some length in the central chapters. Thus, for example, we are told that the first route mentioned above is likely to be the most appropriate where foreign capital is unwelcome or where only a limited amount of specialised knowledge is required. For most purposes, however, the medium of the joint venture is preferred, since it enables the local partner to benefit extensively from the technical, administrative and commercial services of the United Kingdom firm without surrendering financial control, whereas British dominated enterprises flourish where relationships with the importing country are particularly favourable or where the establishment of a joint partnership is an impracticable proposition. The author has based his findings partly on information obtained from interviews with business-men and answers to written questionnaires and partly on glimpses of practical experience which he was able to obtain and assemble. Mr. Fforde states that his task has been not so much to give a factual description of his subject as to suggest a logical framework within which the problem of the transmission of managerial skills might be discussed. Only occasionally are suggestions made for the improvement of the routes described—and these are very tentative.

The end product, though a scholarly piece of work, is handicapped by a number of deficiencies. Too often the essence of a particular argument is lost or rendered meaningless by flowery writing and cumbrous phraseology. The terminology is sometimes hard to understand—such contrived phrases as "purchase dogma," "package deal," "positive localization," I found particularly difficult to appreciate. Moreover, as this is first and foremost a piece of empirical research, it is a little disappointing to find that many of the cases studies reported are hypothetical in character; as a whole, the book would have been more interesting had there been fewer broad generalisations and more illustrations of particular points. As it is, most of the book is very hard to read, save where the author allows himself the luxury of a piece of descriptive analysis, which he does very well.

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The Industrial Efficiency of Rural Labour. By C. D. HARBURY, assisted by A. D. SMITH. (Cardiff: University of Wales Press, 1958. Pp. ix + 228. 35*s.*)

THE aim of this study is to help to provide an answer to the question of whether work-people in rural areas are as efficient in factory trades as work-people in urban areas. The method used was to carry out an inquiry covering 423 workers engaged upon similar processes in 19 firms that operated 25 factories in urban and rural areas and a Development Area.

The first part of the book discusses conceptual and practical problems, and also difficulties encountered in finding industries and firms which satisfied the stringent tests of suitability imposed by the author. The second part reports, in eleven case studies, the results of direct tests of the efficiency of the work-people selected. The third part assesses the indirect effects upon efficiency of labour turnover and absence. The fourth part assembles the conclusions reached.

The task of making strict comparisons between the industrial efficiency of factory workers in urban and rural areas is a difficult one. The measure adopted was the study of records of input and output. Although there are various drawbacks to this—especially that identical conditions of production do not exist in separate factories—it was the best of the methods available. Clearly, it is superior to the rival methods of comparing earnings or direct observation of work-people who, knowing they were being observed, could not be expected to behave normally. The author is acutely aware of the drawbacks of relying upon past records of input and output, discusses them comprehensively and supplies detailed reasons for the methods he used to overcome the drawbacks. Moreover, he does not rely entirely upon this evidence: he takes account also of various other influences which affect labour productivity—notably labour turnover, absence and variations in managerial efficiency.

The findings of the inquiry are first, that as judged by direct comparisons of input and output there are no substantial differences in the industrial efficiency of those who work in the countryside and those who work in towns. Second, when differences were observed, they did not appear to be due to any one outstanding cause.

Because the study was restricted to a small number of work-people; limited to 25 factories and 27 processes—and to processes few of which called for a reasonable degree of skill; and, moreover, concerned predominantly Welsh rural workers and English industrial workers living in three only of the eleven administrative regions of Great Britain; the results cannot support a general conclusion. This verdict accords with that of the author, expressed in earlier chapters, and re-stated in the last chapter. Nevertheless, the inquiry has been worth while, if only because the rigorous and detailed examination made of the capacities of the rural workers surveyed challenges the oft-made assumption that their industrial efficiency does not match that of industrial workers.

Mr. Harbury has produced a very competent study of his subject which should be read by everyone who is interested in, or concerned with, the effective utilisation of the reserves of labour to be found in the British countryside.

JOSEPH SYKES

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Nationalisation in Britain: The End of a Dogma. By R. KELF-COHEN. (London: Macmillan, 1958. Pp. x + 310. 25*s*.)

THE main purpose of this book is to explain the reasons which have led Mr. Kelf-Cohen to abandon his former belief in nationalisation and to advocate private ownership of industry. It is primarily an essay in persuasion, but since the author's views have changed chiefly as the result of practical experience of nationalisation since the war, the greater part of the book is devoted to a factual survey of recent events and problems.

This survey comprises two series of chapters, one on each of the main industries nationalised since the war (excluding air transport), and one on each of a number of aspects of nationalisation, such as the parts played by Parliament and the government, problems of finance, staff and the protection of consumers. Whatever one may feel about the political arguments, these chapters are well written and informative, and complete without being unduly detailed. The book is not particularly concerned with the economics of public enterprise, and where this aspect is considered there are occasional remarks which most theorists are likely to find questionable.

On the political side, a really persuasive argument for the superiority of capitalist organisation in the industries under discussion would have required a thorough investigation of the principles which should govern their economic policies, a task which is beyond the scope of this book. Mr. Kelf-Cohen does, however, establish that many of the claims which have been made for nationalisation were extravagant, and that numerous problems remain, some of them specifically due to public ownership. Unfortunately, he rather spoils his argument by giving the impression at times that he is biased against the policies of nationalised industries, whatever they happen to be. This criticism is difficult to document briefly, but here is an example taken from the discussion of coal: on p. 33 we hear that "each year a wage increase is negotiated, which enables the miners to retain their position as the most highly-paid workers in industry. As coal is seriously short, increases are accepted by consumers with muttering resignation; it has been a perfect example of a seller's market." On p. 182 we are told that coal was sold too cheaply. There is no explicit contradiction, but neither is there an atmosphere of impartial judgment. Again, a more careful distinction should have been drawn between difficulties which are due to the new institutions and those which are independent of them (and therefore irrelevant to the main argument). Such problems as miners' absenteeism, concession coal, decreasing returns in mines and the proportion of small coal are not, of course, laid at the door of nationalisation, but they are enumerated during the discussion of it in a way which contributes to the general feeling of gloom and makes the reader feel that nationalisation must be a bad thing. Mr. Kelf-Cohen is also rather hard on the Socialist side of that extraordinary debate on nationalisation which took

place between the wars, for there were striking myths and dogmas on both sides—for example, the belief of some opponents that nationalisation was quite incompatible with economic progress, scientific discovery and personal freedom.

It is, at least potentially, a great merit of the approach adopted by Mr. Kelf-Cohen that his arguments are based on a detailed consideration of particular industries and problems. Much of the debate on this subject has been conducted in ideological terms which are too wide for the purpose and tend to exaggerate differences of opinion. In practice, the area of disagreement can often be greatly reduced by concentrating on the detailed needs of particular industries or on the needs of the economy at a particular time. Thus some industries were nationalised by Conservative governments, while in others the choice (in practical politics) is between public ownership and detailed control, and depends largely on special considerations of administrative efficiency. Again, the form of ownership may be quite subsidiary to substantive issues of policy, and depend largely on the decisions taken on these issues. For example, in the case of the railways the question whether an investment programme which is unlikely to pay its way, and a public subsidy, are justified is more important than the question of ownership. If it is decided to subsidise an industry, the case for public ownership may be strengthened. Of course, the form of organisation does influence policy, and the ideological considerations have some relevance. Nevertheless, it seems to the reviewer that problems concerning particular industries are often easier to settle than general ideological issues, and that the importance of the question of ownership has been over-rated on both sides. Mr. Kelf-Cohen, dealing with one industry and one problem at a time, had the opportunity to distinguish clearly the general from the special questions, the vital from the unimportant, the ideological from the technical and administrative, and thus to narrow down the controversy and reformulate problems in a way that might lead to a greater measure of agreement. Although he has some useful discussions of particular questions, and has produced a book which students of the subject should certainly read, I feel that he has missed the wider opportunity because of his anxiety to convey his political message.

LUCIEN FOLDES

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The Fertilizer Industry. By J. W. MARKHAM. (Nashville, Tennessee: Vanderbilt University Press, 1958. Pp. 238. $6.00.)

THIS industry study is mainly concerned with the examination of the social costs of market imperfections, due first to restraints on competition and second to imperfect knowledge on the part of the consumer. The several sections of the industry are described, and both the ways in which the Government has attempted to deal with the imperfections and future policy are discussed.

The industry is very suitable for detailed case study, because it has a number of well-marked characteristics which can be measured. Professor Markham's emphasis on the joint importance of both anti-trust policies and policies to reduce imperfect knowledge is new and stimulating. Unfortunately the book does not give a clear impression of the main forces at work at any particular time. Part II deals with the organisation and structure of the integrated fertiliser industries and Part IV deals with primary production and distribution practices in these industries. As each section covers more than thirty years the division causes complications.

In the preface Professor Markham says that the preparation of a detailed industry study is a tedious, painful and often dull process. He gives a great deal of information, but much of the book is difficult to read. The difficulties lie partly in the fact that Professor Markham's methods are such that the reader is neither in a position to judge for himself nor given the confidence to accept without question the conclusions reached. Confidence is important in this type of work because so often detailed facts and figures illustrate or support particular conclusions, but do not prove the importance of general points.

For example

> "The weighted average rate [of return] is nearly three times the five to six percent usually considered to be the 'normal' or competitive rate of return, and about four times the average long term interest rate for the same period. Accordingly, for the period 1938–46, it can be reasonably concluded that monopoly profits amounted to from two thirds to three fourths of the total profits earned by producers of fertilizer materials, or to about $12,000,000 per year."

When Professor Markham turns to the social costs of imperfect knowledge he calculates on the basis of 1949–50 figures that, had farmers used concentrated high analysis fertilisers rather than a large proportion of low analysis fertiliser, they could have reduced the fertiliser bill by 10·5%. Having discussed the Tennessee Valley Authority's experience, he concludes that "manufacturers clearly had little incentive to produce more [concentrated superphosphate] than they did, though farmers had a strong incentive to buy it in much larger quantities." This conclusion supports the view that the imperfect knowledge was the most important market imperfection. Imperfect knowledge is certainly a very strong barrier to effective competition, but Professor Markham overplays his hand. The production of concentrated superphosphate doubled between 1946 and 1950 and doubled again by 1953; in 1954, with the output of concentrated still rising, the output of ordinary superphosphate fell substantially. Further, a mild agricultural revolution was taking place, and the consumption of fertilisers, after remaining almost static in the inter-war period, doubled between 1941 and 1949, and had increased by about a further fifth by 1953. By drawing

apparently static conclusions in an intensely dynamic situation, Professor Markham exaggerates the seriousness of the situation.

Nevertheless, this book provides much information about an interesting industry, and presents a vigorous attack on important problems.

P. Lesley Cook

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Shipbuilding in Britain. By L. Jones. (Cardiff: University of Wales Press, 1957. Pp. 244. 30*s.*)

This volume had its origin in a thesis submitted for the master's degree, but was subsequently revised and re-written into its present form. It covers an historical account of the industry in the nineteenth century and thereafter concentrates on the period between the two wars, with separate chapters on the factors which affected the demand for new ships, the importance of foreign competition, new ship construction and the efforts at concentration and rationalisation of shipbuilding capacity. Subsequent chapters deal with problems of state aid, labour relations, wage-rates and earnings, and a final chapter endeavours to assess the future prospects of the industry.

Mr. Jones has devoted much industry to the collection of his material, and much of what he has written is useful. But the result is disappointing in two main respects. The planning of the book is unlikely to give the reader a satisfactory grasp of the problems which are discussed, and there is some unnecessary and irksome overlapping of treatment. Thus the reader who hopes to learn the facts about new tonnage will not find them in the chapter on production as he might expect but in the chapter on foreign competition, to which they are incidental. Secondly, it is difficult to understand why the author, who appears to have completed his manuscript in 1955 or 1956, should have limited himself so much to the inter-war period. The industry's problems acquired a new importance at the end of the Second World War and the inter-war period was becoming increasingly irrelevant, except as a matter of history. If considerations of space prevented Mr. Jones from attempting an adequate treatment of these later problems he might easily have sacrificed his opening chapter on the nineteenth century. This opening chapter indeed does not add much to our existing knowledge, and neither limits itself to the nineteenth century nor sets the scene for the discussion of the inter-war problems.

British tonnage is now about the same as in 1914, though world tonnage has more than doubled. New output from British yards has not increased beyond the pre-1914 output despite the great increase in the volume of seaborne trade. This is one outstanding feature of the contemporary picture

of the British industry. Much of the new tonnage being produced in other countries is intended to sail under the flags of these countries, but there is also the tonnage produced for other flags and the extent to which British yards have maintained their position in these two markets. This is the setting for any study of competitive efficiency, free or otherwise, but it can hardly be said that Mr. Jones faces up to the questions which confront the industry to-day. It is not quite clear whether it was the author's intention to write a work of history or to make a serious contribution to an examination of the industry's problems, and this uncertainty runs through the whole volume. It is perhaps the main source of the disappointment which the reader is likely to experience.

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Banks and Politics in America from the Revolution to the Civil War. By BRAY HAMMOND. (Princeton, N.J.: Princeton University Press (London: Oxford University Press), 1957. Pp. xi + 771. 100*s*.)

IT is not too difficult to look leniently upon Nicholas Biddle. Nicholas Biddle was intelligent. As in the case of Alexander Hamilton, one is inclined to slur indulgently over his paternalistic attitude towards the infant American economy. But in spite of prejudice in his favour, a prejudice of which I am as guilty as Mr. Hammond, one is continuously being brought up short by the fact that, unlike Hamilton, Biddle was so blatantly a fool. Perhaps if he had, like Hamilton, had his own way to make so that he had come to the presidency of the Second United States Bank with more experience, things might have been different.

But there is an even more immediate reason for Mr. Hammond's admiration for Nicholas Biddle, an admiration which is grudging and tempered by impatience but nevertheless real enough to make him slide over some of the more dubious episodes in Biddle's career. Mr. Hammond is a central banker himself, and he sees in Nicholas Biddle an early central banker. Thus, Mr. Hammond says of the Bank of the United States:

> "The central banking function was conducted by the Bank of the United States in two ways, of which one was self-acting and one was discretionary. Controls were self-acting when the Bank, as it received the notes of state banks in the deposits of government collectors and otherwise, required payment of them by the state banks. Save when the state banks would not or could not meet their obligations, this regulatory function proceeded in routine fashion; and its restraint upon the lending power of the state banks was comprehensive and effectual. It could be readily modified by the Bank's abstaining from the demand for payment and allowing the state banks to run into debt

to it. This was discretionary and qualified the automaticity of the function" (p. 301).

Mr. Hammond goes on to point out that this discretionary power could be used to deal with those general circumstances over which individual banks had no control, "to counter-balance or mitigate the drift of money to and from the economy, from region to region within it, and from bank to bank" (p. 301). He then quotes from Professor Jacob Viner on the ineptitude of the management of the Bank of England from 1800 to 1860 and concludes:

> "Be that as it may, the central banking function was apparently as clearly recognized and as successfully performed in the United States by the year 1825 as anywhere in the world—and more clearly and more successfully, I should say, than it was performed there a century later" (p. 324).

Mr. Hammond's predilection for seeing central banking where it is at least questionable whether central banking existed also leads him to write of the Suffolk Bank of New England:

> "The Suffolk was in effect the central bank of New England. . . . It was regulating the extension of bank credit, supporting the country banks, on occasion tightening the curb on them, and responsibly advising them what they should do and what not" (p. 554).

The Suffolk Bank had indeed evolved a method for keeping the note issue of the New England country banks in check. But it is doubtful whether the Suffolk's president's warning to a Vermont correspondent that it had lent too much on accommodation paper was different in principle from the action which a contemporary merchant banker would have taken with respect of one of its correspondents.

The most exciting part of Mr. Hammond's work seems to me to be his analysis of the forces behind the destruction of the Second Bank of the United States. He shows that the effective enmity was not that of the old agrarian interest which President Jackson represented and which hated all banks, but of the state banks and a rising money power which resented control over the expansion of bank credit.

Of the remainder of this book—discussion of the Second Bank of the United States occupies less than three hundred of its more than seven hundred pages—Chapter 18, "Free Banking in New York and Michigan, 1835–1865," and Chapter 19, "The West: Monopoly, Prohibition, *Laisser Faire*, and Regulation, 1830–1865" are particularly to be recommended.

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British Investments in Latin America, 1822–1949. By J. F. Rippy. (Minneapolis, Minnesota: University of Minnesota Press (London: Oxford University Press), 1959. Pp. xii + 249. 40*s*.)

Professor Rippy has attempted to construct a coherent narrative out of seeming chaos by handling his material in three consecutive frames. The first section deals with the subject chronologically and, except for a lively sub-section on Chilean nitrates, is largely a recapitulation of the information set forth in the tables. The second section is a country-by-country survey of the amount and profitability of different categories of investment—investment in government securities, in railroad securities—for various dates; a number of individual companies are also discussed briefly.

The third section is ambitiously entitled " The Crux of the Matter in Global Setting." In Chapter XV the author compares the rates of return of twenty-three very profitable British enterprises operating in Latin America with the rates of return of selected British companies in the Orient and Africa. In Chapter XVI Professor Rippy uses rates of return calculated from material in the Bank of England's *United Kingdom Overseas Investments, 1938 to 1948* to compare the profitability of British investment in Latin America in the two years 1939 and 1948 with that of British investment in various Commonwealth, Empire and foreign countries in the same years, without realising the difficulties involved. Chapter XVII deals briefly with the attitude of various Englishmen to foreign investment, while the final chapter purports to discuss the attitude of Latin Americans to investment by foreigners.

In this last chapter Professor Rippy points out that Latin Americans have, in general, preferred " portfolio to direct investments and, in recent years, loans and credits from foreign governments rather than capital supplied by alien private investors " (p. 214); draws attention to the " persistent trend toward state socialism . . . evident in many Latin-American countries " (p. 215); and concludes that the " prospects for the rapid development of Latin America by a flood of foreign private capital were not bright at the middle of the twentieth century " (p. 216). Nor is the author optimistic about operations under Point Four:

> " the ' bold new program,' otherwise known as Point Four, or described as an economic development plan, seemed likely to turn out to be a project to stimulate economic progress in the retarded countries at the expense of the taxpayers of the United States and some other highly developed nations, and as much for the economic benefit of exporters, importers, shippers, and bureaucratic technicians as for the welfare of the recipients abroad " (p. 217).

Anyone who undertakes so wide a subject must necessarily impose strict limitations upon himself, for he cannot hope to cover the field exhaustively. Nevertheless, the title and, more especially, the sub-title of this

book, *A Case Study in the Operations of Private Enterprise in Retarded Regions*, are misleading. Professor Rippy is concerned virtually entirely with the profitability of British investment in Latin America. Profitability is undoubtedly one of the most fascinating aspects of overseas investment. It is therefore unfortunate that Professor Rippy has been content to present only figures for nominal capital and for the return on nominal capital. In working in this field one wants not only figures for nominal capital but also figures for the issue prices of securities and for the prices of securities net of the commissions and/or profits of the issuing agencies. Information on the commissions and profits of issuing agencies is indeed sparse, but in many cases there is no great difficulty in searching out the prices at which securities were issued to the public. In a table giving country-by-country totals the use of nominal capital is probably defensible, *faute de mieux*, but this is surely not the case in tables dealing with individual companies. However, Professor Rippy does, in many cases, draw attention in the text to stock dividends. Professor Rippy also limits his study to the issues of incorporated companies, mainly those listed in the *Stock Exchange Year-Book*. These limitations materially affect the value of this pioneering study.

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The Commonwealth Economy in Southeast Asia. By T. H. SILCOCK. (Durham, North Carolina: Duke University Press for the Duke University Commonwealth Studies Center (London: Cambridge University Press), 1959. Pp. xviii + 259. 30*s*.)

THERE are two ways of tackling that much written-up subject, the development of the underdeveloped. The one is the approach from theory, from the consideration of what could or should happen within the confines of a particular model; the other starts from an examination of a particular problem or a particular region and goes on to speculate how far conclusions suggested by that examination can be generalised. Professor Silcock's new volume, based on lectures given at the Duke University Commonwealth Studies Center, is an admirable example of the second approach.

He shows little sympathy with the developmental model-makers or with mechanistic capital–output ratios. His suggested conclusions are based on an open-minded attitude to the problems of adaptation of economic institutions to local political and sociological circumstances, and a willingness to recognise the parts to be played both by private enterprise and by control, stimulus and direct action on the part of governments. He keeps firmly to the essential problem of all sound economics—the most effective use of all available resources; he recognises that enterprise and organising capacity are themselves resources which are sometimes particularly strictly limited;

and he faces frankly the moral problem of an advising economist who finds that the best way of harnessing enterprise itself as well as other resources in a particular social background may be distasteful or repugnant to his political or social convictions. (This can happen either to the *laissez-faire* economist compelled to recognise a need for state action or to the socialist economist compelled to recognise a need for private initiative.)

The first chapter of factual description, qualitative rather than quantitative, is best in the sections dealing with the areas covered by Professor Silcock's personal experience, particularly Malaya, Singapore and Sarawak. The section on Hong Kong is brief and confessedly no more than a sketch. There follows a chapter on relations with the Commonwealth, concerned with broad effects rather than details, and recognising how valuable the Commonwealth connection has been in the past without ignoring the need for wide adjustments in the future as political independence grows. If (with his original American audience in mind) he exposes some common fallacies about imperialism he does it gently and without losing his obvious sympathy with the indigenous peoples.

Professor Silcock goes on to " Assessments and Suggestions " and a final chapter on " The Determinants of Economic Development," each of which contains many sober and penetrating observations and stimulating suggestions. In his comments on the potential local money market in Malaya and Singapore and the existing monetary structure, I think he underestimates the difficulties of building up by any conscious action a short-term market, while he overestimates the benefit Malaya might get from creating a money and capital market of its own if that meant interfering with the area's present easy access to the London market. Disregard of the intimacy of the credit and banking connection with London leads also to an undervaluation of the built-in stabilising influence which the existing currency mechanism provides; Professor Silcock rather assumes here that any good results which are not the effect of conscious decisions are " accidental " rather than being predictable results of the system.

That is, however, one of few points of criticism. Much more interesting are Professor Silcock's reflections on such deeper problems as those of attitudes to economic development, connected with the differing social values of different communities; of the sociology of colonialism; and of the differences in the forms of business organisation appropriate or congenial to different peoples. On attitudes and social values, Professor Silcock takes no simple-minded line; if he concedes that such peoples as the Malays need to show more private initiative he suggests also that the Chinese, who cannot be accused of lacking in enterprise, need to show more public conscience. He particularly remarks, too, that the driving force which started other countries—Britain, Japan, the U.S.S.R. or any other—on the path of economic growth, seems never to have been an undiluted search for personal material benefit.

In the phrase "sociology of colonialism" I include Professor Silcock's very interesting discussion of the economic organisation of the type of territory, such as Malaya, "where a transient group of Europeans build up a culture for themselves which the local population at first wishes to imitate but which is not appropriate to the local setting once the Europeans leave." It is frequently argued that Colonial territories cannot be expected to take over Western political institutions without modification. Professor Silcock shows how this same problem arises with economic institutions, not merely in relation to the introduction of specific western institutions (such as Central Banks, where he seems in danger of falling into the type of trap he warns others against) but also, at a much lower and more detailed level, in the reorganisation of personnel in existing organisations. He points out that the replacement of Europeans by local inhabitants in a business enterprise can rarely be done just by appointing a local man to fill every post previously filled by a European. These posts were designed, and the whole organisation of which they are a part was designed, to be filled by people with the qualities, good and bad, of expatriate Europeans. The organisation will therefore need subtle but extensive reorganisation if it is to be reconstituted of posts designed to be filled by locally domiciled people with different qualities. Professor Silcock suggests specifically that the Chinese in Malaya suffer from so much private initiative that it is impossible for them to take over unchanged the kind of large-scale Western business structure which requires a "professional" attitude of mind in its managerial staff.

This leads on to emphasis on the need to study far more closely than has ever been attempted hitherto the specific forms of business and credit organisation which come naturally to the local—and especially the Chinese—populations of South-East Asia. Professor Silcock does little more here than put up some sign-posts for inquiry, but he looks far enough down the roads they point along to make one hope that he or someone else will follow them much farther. Perhaps one day this fruitful task will be undertaken by a school of Business Administration in the University of Malaya or the University of Hong Kong.

There are many other topics on which it is clear that, given more space, Professor Silcock would have had much more of interest to say; the problems of rapid population growth and the repercussions on capital creation of such growth; the role of education in economic development; the part which might be played by external aid. In the very full reading list of books and articles bearing on the economy of Malaya and Singapore, which occupies the last thirty-three pages of the book, one is conscious of one vital omission—the complete description and analysis of the Malayan economy which Professor Silcock must surely one day give us.

SYDNEY CAINE

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The Fabric of Society. An introduction to the social sciences. By R. Ross and E. VAN DEN HAAG. (New York: Harcourt, Brace, 1958. Pp. xv + 777. $10.00.)

FACED with 750 pages in double columns, the reviewer is tempted to categorise this book as yet another compendium on general sociology. But it is something different. Instead of spending space discussing the *subject*—its methods, its scope and its literature—the authors dive into the deep end of the pool at once.

They first take man the social animal. They start with him as an infant, and that leads naturally to psycho-analysis. When the individual psyche has been examined they pass to the institutions, which also mould the psyche, and thus to the groups which have, as it were, lives of their own. Role, status, class, leadership are all discussed, and the authors then examine what is meant by culture, which they divide into two kinds—the official culture of a society, its ideals and its aspirations, and the mass culture formed by multitudinous forces.

Then the authors turn to the way we intellectualise about experience. They analyse science and social science; they explore language, religion and art. From this they turn to a more de-personalised branch of social study, economics, and examine its concepts, such as prices, growth, labour, wages, monopoly and competition, and relate these to the structure of society; and they summarise the alternative system to capitalism which obtains in the U.S.S.R. Finally, they consider politics, which they rightly examine in terms of power. International relations, parties, the contradictory ideals in democratic government and the nature of bureaucracy are all discussed to show how man, the political animal, organises his life.

We call such a work a text-book because it is not tackling any specific problem or making a series of new hypotheses or re-assessing work done by others. But it is a new kind of text-book. It is chatty, discursive and amazingly free from jargon. It provides an introduction to almost everything—an introduction based on the more important books written on the subject in the past thirty years. It is particularly good in frequently illuminating a point by quoting a poem or a character in a novel, or a passage from John Dewey or Schumpeter or Mgr. Knox, so that an arts student fells that social analysis is related to the kind of literature to which he is accustomed. Inevitably a good many paragraphs state the obvious. The work proceeds by the authors' posing questions and answering them: " Is the artist's perspective, his meaning system to be judged by the truth of what it conveys? " " Why is Brooklyn so much richer and bigger . . . and less productive culturally than was Florence? " At other times they use lucid and able surveys of a topic such as international law or scientific observation, occasionally calling in an expert such as Planck or Robert Merton to clinch the argument.

The book's sub-title is misleading. It is called " an introduction to the social sciences," and mercifully it is not that: mercifully, because such a

claim suggests that it contains separate accounts of how social scientists in different fields operate and what claims they make for their subject. Nor does it give an account of what the different social sciences are, or indicate what lines of inquiry are now popular and why. It is really a personal account of what is generally accepted about a mass of topics—the general way in which social scientists look at things—when they analyse society.

Here it is, then, on a plate. Will the hungry sheep look down and feed? Well, possibly. Well-known works of popularisation such as the Wells–Huxley–Wells *The Science of Life* of a generation ago had greater unity and power of narrative; and the very bulk of books such as that and this lead purchasers to lay them on a table and then on a shelf rather than read them. *The Fabric of Society* is emphatically not a cram-book, and it contains a vast amount of information based on compendious reading and up-to-date articles which would genuinely enlighten any student who is beginning to study the social sciences. Paradoxically it may fail in its object precisely because it is so complete and always exhibits the finished product of learning and research. Pupils need an outline of their subject—short, readable, even perhaps contentious. Thereafter they need to read works which are arguing and which involve them in the arguments, or which review some one aspect of a particular field. The danger with this book is that it scarcely implies that there are differences of opinion between scholars about dozens of the concepts and topics which are set out so clearly. At the university good students ought to learn from the great works of original scholarship; the bad ones unfortunately content themselves with reading something infinitely less substantial, stimulating and complete than *The Fabric of Society*.

Against this must be set many merits. This book is written in clear, readable English by men who treat the subject imaginatively and are cultivated. They are cultivated not in a whimsical and affected manner but because they can turn from articles on population statistics to Bodin on the rights of states; they discuss the function of funeral rites by referring to the deaths of Hector and Hamlet. They illustrate with *New Yorker* cartoons role change and relative deprivation and throw in a mention of William James for good measure (the jokes, alas, are laboriously explained in a way that must cause Ross's ghost to walk). Everywhere this study reaches out into other subjects, philosophy, mathematics, literature and history; and if the conclusions which are put forward in each section are simple and the slopes climbed are gentle, the reader covers an immense amount of ground. The society which the authors present is, of course, the United States but they are prodigal in their references to this and other countries. It is neither parochial nor technical, and it is far better than dozens of other duller works which claim to survey the same area.

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NOTES AND MEMORANDA

THE RATE OF INTEREST, MARGINAL EFFICIENCY OF CAPITAL AND INVESTMENT PROGRAMMING —REPLY

PROFESSORS Grey and Brockie have provided a great deal of material in rebuttal [1] of the writer's reinterpretation [2] of their own earlier evidence [3] as consistent with usefully high interest elasticity of investment demand. Space does not permit reply on the authors' various citations of authorities, on their introduction of new considerations, many of which are ultimately shown (and a few more of which can be shown) to be irrelevant, and on their misinterpretations of the writer's own position. These are all side issues, however. What is important, although given very little attention in the authors' " rejoinder," is that the rejoinder seems to leave the writer's earlier conclusions unshaken: The authors' original survey of fifty-seven New York Stock Exchange quoted manufacturers is consistent with, and even suggestive of, usefully high interest elasticity of manufacturing investment demand.

The authors now concede the rapid advances in business planning techniques and lengthening of economic horizons that were inferred from their original report, stating that the average maximum acceptable pay-out period for large firms is 7·3 years (median, 6 years). This means that on the average over the first 7 or so years of its use, equipment must earn 13·7% of its original costs *gross* of depreciation charges. (For plants and buildings the figure presumably is lower.) Even assuming so low an annual average depreciation (plus economic obsolescence) allowance as 7%, the average net rate of return implied is only 6·7% of original cost or—if that is not considered the relevant base [4]—say, 9% of original cost less average accrued depreciation. Unfortunately the authors did not indicate whether their survey requested answers in terms of pay-out periods gross of both interest and income taxes (in addition to being gross of depreciation); even assuming the 9% rate to be completely net (and that it rather than the 6·7% rate is

[1] A. L. Grey and M. D. Brockie, " The Rate of Interest, Marginal Efficiency of Capital and Investment Programming—Rejoinder," ECONOMIC JOURNAL, Vol. LXIX, June 1959, pp. 333–43.

[2] W. H. White, " The Rate of Interest, the Marginal Efficiency of Capital and Investment Programming," ECONOMIC JOURNAL, Vol. LXVIII, March 1958, pp. 51–8. Nothing said in this article was intended to reflect on Brockie and Grey's interesting discussion of the marginal efficiency of capital concept.

[3] M. D. Brockie and A. L. Grey, " The Marginal Efficiency of Capital and Investment Programming," ECONOMIC JOURNAL, Vol. LXVI, December 1956, pp. 662–75.

[4] See White, pp. 57–8. The authors' silence on the subject suggests that they would accept the reasons presented for computing average rates of return on an original cost base.

relevant), this would still be a low enough figure to make plausible changes in the cost of (long-term) debt and, especially, equity capital capable of influencing manufacturing investment.

The authors tacitly accept the writer's inference that the survey contained the important finding that 41% of the respondents took the market rate of interest into account in computing the profitability of investment projects financed with *internal* (as distinguished from capital market) funds. The sole reference to this matter ("Our survey disclosed that, on balance, the small firm shows more concern with the interest rate than the large.") [1] may indicate a limited significance for anti-inflationary interest-rate policy effects, for it is the sample's *large* firms (those with 7,500 or more employees) that presumably represent the larger part of manufacturers' capital spending. The authors' uncommunicativeness once more forces us to educated guessing: assuming that the interest-rate question was answered by small and large firms in proportion with their representations in the entire sample, then if no more than one-half (two-thirds) of the "small" firms could plausibly have used the market interest rate in connection with internally financed investment projects, it follows that 34% (21%) of the large firms must have done so. These figures are still entirely consistent with strong investment-restricting effects, for the large (as well as for the "small") manufacturers. As the writer's article described, the form of the question—covering only internally financed expenditures and excluding the cost of *equity* capital—biased the results against the role of the cost of capital (and, therefore, interest-rate policy) in investment decisions.[2] The authors' new report that the ratio of debt to equity external financing is higher for the "small" firms [3] means that the role of capital costs was especially understated in the case of large firms.

The fact that "cheap" money had existed from early in the 1930s until *after* the survey was made leads to a further (unforeseeable) bias: many more firms would presumably pay attention to interest rates today, with rates moving both more volatilely and on a higher average level.

Finally, the authors reassert that their survey demonstrates "noteworthy independence of large [manufacturing] enterprises from the capital market" and hence the "evident unimportance of the market rate of interest." [4] The writer had argued that over one-fifth of manufacturing corporations' long-term financial resources (including depreciation accruals) were obtained externally in all post-war prosperity years. This rate of external financing constituted proof that firms doing the greater part of investment were using at least the 20% of external resources considered to provide adequate contact with the capital market—*unless* it could be shown

[1] Grey and Brockie, p. 340.
[2] White, p. 54.
[3] Grey and Brockie, p. 340.
[4] Brockie and Grey, *op. cit.*, p. 666.

than an important number of (large) firms had "used up" the 20% plus aggregate by obtaining over half of their long-term fund externally. The authors' survey, showing that only 7½% of the surveyed firms were so doing and that all of these were "small" firms, was used (the frame of reference being the implications of the survey) to eliminate that possibility, and the proportion of investment adequately exposed to the capital market thereby established.[1]

The outlines of this argument have been presented because the authors announced its invalidity without saying either what it is or what is wrong with it: "... by means of an ingenious but we think gratuitous deduction concerning the [large?] minority of firms who resort (frequently or only occasionally) to the capital markets for part of their investment funds, he interprets ..."[2] The paragraph containing this quotation continues by offering, as evidence justifying the authors' disbelief in usefully high interest elasticity of investment demand, the failure of the moderate interest-rate reductions to prevent the 1957–58 recession-phase decline in bank lending to business.[3] "Finally, the additional fact remains that among the firms we investigated by far the largest part of investment funds were not obtained from the capital market during the years immediately preceding our study (prior to 1955)," although more was obtained externally in the prosperous years 1956 and 1957.[4]

This sequence of arguments is confusing. If the authors' survey showed that only a small minority, or even a small minority of the large firms in the sample, was using the capital markets, the writer's position would have been shaken. But to attack that position by pointing out: (*a*) moderate interest rate reductions failed to prevent a recession-phase reduction in bank credit, and (*b*) that "by far the largest part" of the surveyed firms' investment funds were not obtained from the capital market—which is exactly the writer's postulate: 80% internal, only 20% external—is to lose the contest.

The Brockie–Grey 1955 survey demonstrates conditions much more favorable to interest rates influencing manufacturers' investment than seemed possible from the earlier evidence available.[5] Further rapid advances in

[1] White, pp. 52–3.

[2] Grey and Brockie, pp. 333–4.

[3] Grey and Brockie, p. 334. Their ascription to the writer of belief that monetary policy is adequate by itself for smoothing the business cycle and is equally effective in recession as in prosperity (pp. 334–5) may be compared with "usefully high interest elasticity of investment demand" and "reopening the case for interest rate policy" (White, p. 52), and with p. 579 of the writer's earlier article cited in the authors' note 3, p. 333.

[4] Grey and Brockie, p. 335.

[5] The authors' rejoinder did reveal that the apparent defect which prevented them from publishing the results of their public-utilities survey (other than a footnote statement that public utilities had better investment-selection techniques, longer expected lives for investments and greater reliance on the capital markets than was true for manufacturers—Brockie and Grey, p. 662, note 1) was simply that the utilities said they give *no* attention to the market rate of interest (Grey and Brockie, pp. 338–9)—not an inconsistent result for a regulated industry that can pass on cost increases but must surrender the benefits of cost reductions.

business investment decision-making procedures and the disappearance of cheap money during the succeeding four years make the possibility of usefully high interest elasticity in the United States still greater.

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A THEORETICAL BASIS FOR SOCIAL ACCOUNTING

No theory of social accounting has been worked out, so far as I know. Aggregation of the figures of a group of companies seemed a procedure which could be extended to the whole economy. The results have not been so meaningful or enlightening as they might have been had a precise logical system been worked out from first principles.[1] The purpose of double-entry accounting is to provide a technique of precise definition and classification of single items which will produce significant aggregates at required intervals. It is based on the device of separating the logically complex notion of property owned or claimed into the two elements of property and ownership and recording the value twice, the value as property in real accounts and the value as ownership or claim in personal accounts—on the opposite side, so that exchange of property, changes in ownership and changes in value are all recorded by means of the same double entry routine, ending in a coherent and intelligible whole; like knitting. When we say that assets equal liabilities or product equals income this suggests, misleadingly, the equality of different things. We really refer to the identity of value in two functions of the same thing, the function of existing and that of belonging to, or being claimable by, some person. Without the initial definition of and distinction between real and personal accounts, social accounts remain vague in meaning and difficult of comprehension.[2] The obscurity is deepened by "capital reconciliations," which cancel all differences, that is the balances which are the significant outcome of the transactions. No business accountant would confuse his records in this way. The fact that no continuity from year to year by way of balance sheet is attempted is no valid reason for this. Aggregation of company accounts and balance sheets into group statements contains only part of the complete system. Social accounts conceived in this way present in effect a system of incomplete records. What will be attempted here is a re-interpretation of a system (that set out in pamphlet No. 2, entitled "A System of National Accounts and Supporting Tables," of the U.N. Studies and Methods series) as a complete double-entry record of national product and income, and to show, in default

[1] "This practice—(reversing the sides of the income account)—arises purely out of the traditional arithmetic of double entry *and has no other significance*" (Edey and Peacock, *National Income and Social Accounting*, p. 165 (my italics)).

[2] "The accounts . . . represent a fairly high degree of abstraction" (*ibid.*, p. 17).

of a full statement of affairs (balance sheet), a statement of changes in national wealth and investment (in accounting terms a statement of balance-sheet changes). As far as possible the content of the individual entries will be taken for granted, although some of these might be examined with a view to improvement.

The accounts should be defined as follows:

Domestic Product Account Capital Formation Account	Real Accounts
National Income Account Households Account Government Account Rest of the World Account	Personal Accounts

The opening double entry is a debit on Domestic Product account of the value of the domestic achievement, with a credit on National Income Account for the personal title to this value in wages, salaries, fees, profits, rents and interest paid or payable to individuals. The value of the domestic product may be found by the following process:

Analysis of the revenue account of an individual firm—

	Producer goods and houses.	Consumer goods and maintenance of capital equipment.
(*a*) Charged for individual earnings (wages, salaries, fees, commissions)	X	X
(*b*) Provisions for replacement of fixed assets	X	X
(*c*) Distributed profits	X	X
(*d*) Undistributed profits, including increases in provisions other than *b*		
= Product value for aggregation	X	X

By excluding all payments to other firms, the aggregates will equal net sales of producer and consumer goods to ultimate users, plus increase in stocks, of home-produced goods; imports are brought in later. Most firms will not have to make any apportionment between producer and consumer goods, but separate totals are required, as will appear.

The product values for firms, aggregated, provide the initiating entry in the social accounts. The debit side of the Domestic Product account may now be illustrated:

Aggregate value of product (credit National Income account)	X
Add Imports (credit Rest of the World account)	X
= Product available to the community	X
Deduct Exports (debit Rest of the World account)	X
= Product retained in the community	X
Add indirect taxation (credit Government account) local rates (credit Government account)	X
= Value of product at selling prices plus increase in stocks at cost	X

The disposal of domestic product is credited on this account and debited:

Households, Government	Consumer goods sold	X
Capital Formation account	Producer goods and new houses sold	X
	Increase in stocks (Producer and consumer goods unsold)	X
		X

The account will balance out.

The credit on National Income account is transferred to the credit of Households account (personal incomes), Government account (taxes levied on corporations); depreciation (capital consumption) is credited on Capital Formation account and the balance (undistributed profits or corporate saving) is carried down.

Capital Formation account is complete for the year and shows net capital formation as a debit balance carried down. Households account has been credited with personal incomes and debited with personal expenditure other than on new houses. Personal taxation is debited here and credited to Government account. The balance, personal saving for the year, is carried down as a credit balance. Government account will show the realised budget surplus (credit balance) or deficit (debit balance), and the net balance of local-authority income and expenditure. The Rest of the World account similarly will show as a credit balance net increase in overseas creditors or net disinvestment, or as a debit balance net increase in overseas debtors or net investment abroad.

The balances carried down can now be scheduled in the form of a statement of changes in national wealth and investment. This is set out below in conventional balance sheet form.

Net Changes in National Wealth and Investment during the Year 19..

(1) Corporate Saving (National Income account)	X	(6) Net Asset Formation (7) Stocks Increase (Capital Formation account)	X
(2) Personal Saving (Households account)	X	(8) Government Deficiency (Government account)	X
(3) Government Surplus (Government account)	X	(9) Increase in overseas debtors (10) Increase abroad (Rest of the World account)	X
(4) Increase in overseas creditors (5) Disinvestment abroad (Rest of the World account)	X		
	X		X

Of these ten items three are alternative, leaving seven actual items for a real case. Five accounts only are used in the exposition followed here. It seems possible that it would not be impracticable to show separate accounts for fixed capital (producer goods) and for floating capital (consumer goods unsold), also for long-term and short-term balances with other countries.

Thus a logically complete system of double-entry social accounts is

available, as easy to understand as the accounts of a single business, leaving the difficulties, which are sufficiently formidable, wholly in the field of statistics.

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"SUBJECTIVE" AND "OBJECTIVE" TAX BURDENS, A REJOINDER

THE question of tax burden has been a universal and eternal problem. In the March 1959 issue of the ECONOMIC JOURNAL A. Morag presents an article on the "Economic Efficiency" of Taxation in which he attributes the terms "subjective" and "objective" tax to Paul B. Trescott. The reference is made to an article in *Public Finance* in 1956. The statement that the phrase "subjective" tax burden is original with Trescott in 1956 is unfounded. Without going into an exhaustive study of when the phrase was first used, one can observe the reference in the works of Hugh Dalton in 1922. From the volume by Dalton we quote: "A distinction may, indeed, be drawn between the subjective and the objective burden of taxation." [1] Dalton points out the fact that the objective burden may be that "viewed by the Statesman," as contrasted with the subjective burden, as viewed by the taxpayer, and varying with the "differences of taste and temperament, even if their economic situation as regards income and other factors, is the same." [2] A perusal of Dalton's volume on public finance will indeed present other commentary on the relative importance of subjective and tax burdens. Among these comments we find: "The primary consideration is the objective burden, as measured by a given loss of resources to a taxpayer in a given economic situation." [3]

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KEYNES' ATTITUDE TO COMPULSORY MILITARY SERVICE

SIR ROY HARROD, "for the sake of the record," has challenged Mr. Clive Bell's description of Keynes as a conscientious objector in the First World War—"of a peculiar and, as I think, most reasonable kind"—and has denied that this was true in "any sense, peculiar or other," dismissing Keynes' behaviour as "just a little gesture of appeasement to his Bloomsbury friends." [4]

[1] Hugh Dalton, *Principles of Public Finance*, London, George Routledge and Sons, Ltd., Ninth Revised Edition, 1936, p. 49.
[2] *Ibid.*, p. 49.
[3] *Ibid.*, p. 50.
[4] R. F. Harrod, "Clive Bell on Keynes," ECONOMIC JOURNAL, December 1957, pp. 692–9, being a review article of *Old Friends*, by Clive Bell.

According to Mr. Bell, Keynes was a conscientious objector *to conscription*. This version of the matter is borne out by a draft letter, written and signed in Keynes' own hand, which gives a considered statement of his personal view. The letter in question and other evidence contained in Keynes' papers, on which I happen to be working, seem to support Mr. Bell's interpretation of Keynes' opinions and actions.

Conscription came into force with the passing of the Military Service Act of January 27, 1916, by which all men between eighteen and forty-one who were unmarried or widowers without dependent children were " deemed . . . to have been duly enlisted." Keynes had from the first disliked and opposed conscription not as a pacifist, which in contrast to some of his friends he never was, but as a liberal who denied the right of the State to abrogate to itself a decision which he and many other liberals believed should be a decision for the individual. In the course of the previous months he had been increasingly concerned about the morality of conscription, about its possible economic effects,[1] about his own personal duty in relation to it [2] and about its consequences for some of his friends.

It is clear that Keynes had been thinking in advance about his own personal position and duties. We can trace the actual events of the next few

[1] Among the Keynes papers are copies of memoranda written by him towards the end of 1915 in which he argued that the country could not afford the dislocation to industry and shipping which would result from conscription and that the financial help which Britain could give her Allies as an alternative was both more economical and more valuable politically. It is clear that the Chancellor of the Exchequer, Reginald McKenna, accepted this view, and argued it, though without success, with his colleagues (see *War Memoirs of David Lloyd George*, Vol. II, Chapter XXIII, p. 720, 1938 edition, Vol. I, p. 432).

It was this stand that Keynes took in a long letter published in the *Daily Chronicle* of January 6, 1916, under the pseudonym " Politicus." The final paragraph is as follows:

> " Those who believe that the true Englishman is one who throws himself not where he is most efficient but where his personal sacrifice will be greatest, who believe that our duty to the Allies is not to help them most effectively but to impress them with the nobility of our self-sacrifice by getting as many of our men killed or maimed as we plausibly can, or who believe that the chief test of patriotism is an eagerness to dissipate the national resources at the maximum possible rate, will find much moral solace in compulsory service. But in the business of war there is no room for such sentimentalities. That is not the way to beat Germany."

Keynes appears to have followed this attack on the proposed Conscription Act by suggesting amendments to it, which he sent to Philip Morrell, a Liberal Member of Parliament and a personal friend, while the Bill was being debated. A reply over Morrell's initials, thanking Keynes for his letter and amendments, is in Keynes' files.

[2] The following extracts from the diary of his father (John Neville Keynes) during January 1916 show his thinking at this time:

> " *Jan. 6* (The two elder Keynes were visiting J. M. K. in London) . . . The Government have decided on compulsory service for single men. Maynard talks of resigning his post at the Treasury, and we are very much worried about him.
> " *Jan. 14* Maynard writes, ' Things drift on, and I shall stay now, I expect, until they begin to torture one of my friends. I believe a real split now and a taste of trouble would bring peace nearer, not postpone it; otherwise I'd swallow a great deal. I've been very busy and with occasional excursions into high life,—met the P.M. at dinner on Saturday, refused to dine with the old scoundrel on Sunday, banqueted with the Lord Mayor yesterday.'
> " *Jan. 16* Maynard is home today . . . I am afraid he takes an extreme view on conscription.
> " *Jan. 28* Florence [Mrs. Keynes] . . . saw Maynard in London. He is still thoroughly interested in his work, and Florence does not fear his throwing everything up in consequence of the Compulsion Bill."

months in a small file among his papers which contains the documents concerning both his exemption and his application to the Holborn Local Tribunal. It begins with a letter from Sir Thomas Heath, Joint Permanent Secretary of the Treasury, dated February 23, 1916. This is accompanied by a certificate of exemption for six months from the provisions of the Act, issued the same day by the Treasury, " being a Government Department under Section 2 (2) of the Act." The covering letter reads as follows:

> " I understand that you have not attested under the Derby Scheme [1] and I have had consequently to take into consideration your position with regard to the Military Service Act. It has been decided to issue in your favour the enclosed certificate of exemption from the provisions of the Act, limited to a term of six months from the 2nd March, 1916, on the ground that you are engaged on work of national importance.
>
> " It will rest with yourself to make any representations which you may desire to put forward to the Local Tribunal on any of the grounds enumerated in Section 2 (1) (*b*) (*c*) and (*d*) of the Act." [2]

The facts, then, are that Keynes was given a temporary exemption by the Treasury, so empowered by the Act, and that he was informed that it rested with himself to make any claim on other grounds, including conscientious objection, to his Local Tribunal.

It is clear that he did wish to put himself on record. If he had not so wished, there was no reason why he should have approached his Local Tribunal at all. He was exempted in virtue of his work. His approach to the Tribunal must have been made because he wished to be exempted in addition on one or other of the grounds of hardship, ill-health or conscientious objection.

[1] The Derby Scheme was the final attempt to recruit by voluntary means before the adoption of compulsory service in January 1916. Men in vital industries were urged to attest that they would serve with the forces when they were called, but were not to be enlisted. (See David Lloyd George, *War Memoirs of David Lloyd George*, Vol. II, Chapter XIII, pp. 709 ff., 1938 edition, Vol. I, pp. 434 ff.; also H. M. D. Parker, *Manpower* (History of the Second World War, United Kingdom Civil Series), Chap. 1, Sect. 1, especially p. 3).

[2] Under the Military Service Act 1916 there were in effect two methods by which exemption could be granted:

> (i) The individual could make application to a local tribunal on the grounds of: (*a*) national importance of work; (*b*) hardship; (*c*) ill-health; (*d*) " a conscientious objection to the undertaking of combatant service."
>
> (ii) Certificates of exemption could " be granted by any Government Department, after consultation with the Army Council, to men or classes or bodies of men, in the service or employment of that Department, or, in cases where it appears to the Department that certificates can be more conveniently granted by the Department than by the local tribunal, to men or classes or bodies of men who are employed or engaged or qualified for employment or engagement in any work which is certified by the Department to be work of national importance and whose exemption comes within the sphere of the Department."

It should be noted that Keynes had already been granted exemption under Method (ii) on the grounds that he was " at present engaged on work of national importance." Sir Thomas Heath's letter left him, if he wished, to make application himself on grounds (*b*), (*c*) or (*d*): hardship, health or conscientious objection.

That his approach was on grounds of conscience is clear from a completed draft of a statement of his case to the Local Tribunal. It is addressed to " The Tribunal " and written on King's College writing-paper in Keynes' own hand-writing, dated February 28, 1916, and signed by him. It is as follows:

" King's College,
Cambridge.
28.2.16

" I claim complete exemption because I have a conscientious objection to surrendering my liberty of judgment on so vital a question as undertaking military service. I do not say that there are not conceivable circumstances in which I should voluntarily offer myself for military service. But after having regard to all the actually existing circumstances, I am certain that it is not my duty so to offer myself; and I solemnly assert to the Tribunal that my objection to submit to authority in this matter is truly conscientious. I am not prepared on such an issue as this to surrender my right of decision, as to what is or is not my duty, to any other person, and I should think it morally wrong to do so.

" J. M. Keynes " [1]

There survives no absolutely certain evidence that Keynes sent precisely this statement to the Holborn Tribunal. But we do know that Keynes was asked to appear before the Tribunal and that must imply that he had made application to do so. The next item in the file is a postcard, post-marked " 24 Mar 16 " and addressed to him at 3 Gower Street, from the Clerk to the Holborn Local Tribunal notifying him that the application in respect of J. M. Keynes would be considered on the 28th day of March 1916 at 5 p.m. This is presumably what Sir Roy Harrod refers to as the " calling-up notice " to which Keynes " replied on Treasury writing-paper that he was too busy to attend the summons." [2] On Mr. Bell's version that "As for his conscientious objection, he was duly summoned to a tribunal and sent word that he was much too busy to attend," Sir Roy Harrod now comments that " incidentally it was not when summoned to a ' tribunal ' that he pleaded that he was too busy, but when he received his ordinary calling-up notice." [3]

This interpretation seems impossible in the light not only of the surviving evidence but also of Keynes' position at the time.[4] The evidence seems to accord closely with the memory of Mr. Bell, who, since Sir Roy Harrod published his comment, has written in a private letter to say that Keynes " was

[1] No words are crossed out or changed in the draft, but the word " morally " in the last sentence is inserted with a caret. Keynes typically wrote only one draft, although he might correct it extensively.

[2] Harrod, *The Life of John Maynard Keynes*, p. 214.

[3] *Ibid.*, " Clive Bell on Keynes," *loc. cit.*, p. 696.

[4] The card is headed " Holborn Local Tribunal " and is signed by the Clerk to the Tribunal. Keynes had been given by the Treasury on February 23, as mentioned above, exemption from the provisions of the Military Service Act for a period of six months from March 2, and was thus not liable for call-up at any moment during this period.

duly summoned to a tribunal, but was summoned to a conference of considerable importance at the same hour. He sent word that he was too busy to attend—or words to that effect" (Mr. Bell has described how he saw a good deal of Keynes at that time).

That Keynes' application actually came to a hearing is clear from the fact that the postcard from the Tribunal is followed in the file by a letter addressed to Keynes at Treasury Chambers, from the Clerk to the Holborn Local Tribunal, dated March 29, 1916, referring to a letter from Keynes of March 27 and informing him that his application for exemption was dismissed, "having regard to the fact that you have already been exempted for six months by the Treasury." He would be entitled, if he desired, to put in an application for further exemption after six months. Thus it is beyond doubt that Keynes' application was heard *in absentia* on the basis of some written statement of his case, similar, if not identical, to that which remains among his papers.

In fact, the Treasury renewed his exemption, conditional, without apparent time limit, on his remaining in their employment. The certificate, dated August 18, 1916, is in the file. When Sir Roy Harrod writes that "this appears to have quelled the authorities, for he was troubled by them no more," [1] he is referring to Keynes' letter in which he is supposed to have said that he was too busy to attend the summons. It seems, however, that it was not this letter but the indefinite exemption granted by the Treasury which settled the matter.

In *The Life of John Maynard Keynes* Sir Roy Harrod goes on:

> "On the other hand, he did not carry this policy through to its final conclusion, for a year or two later the Treasury discovered a gap in its records. In the file there was no notice of exemption against his name. And so, to placate the Treasury Establishment Officer, he walked quietly round and went through the formalities of obtaining exemption."

Keynes' papers include a certificate of registration under the National Registration Acts, 1915 and 1918, dated March 26, 1918. It may be this that Sir Roy Harrod here refers to. But the certificate is a certificate of registration and not of exemption.[2]

[1] Harrod, *The Life of John Maynard Keynes*, p. 214.

[2] The National Registration Act, 1915, required "all persons, male and female, between the ages of fifteen and sixty-five (not being members of His Majesty's naval forces or of His Majesty's regular or territorial forces), subject to the exceptions mentioned in this Act" to register and provide certain particulars about themselves. It was in effect a census of the adult population, and though used as an instrument for the Military Service Act, had a much wider and less specific coverage. The Act of 1918 was designed to tighten up the administration and *inter alia* added an obligation on employers to ask all male employees affected to produce a certificate of registration. Apparently registration under the 1915 Act was far from complete (see M. B. Hammond, *British Labour Conditions and Legislation During the War*, Chapter VI, p. 127), and it is possible that Keynes, like others, had neglected to register under the earlier Act.

Of Keynes' views over the following years we know less from his papers. His application had been rejected by the Holborn Tribunal on the ground that he had already been exempted by the Treasury. When the Treasury in August 1916 exempted him without limit of time, conditional on his remaining in Treasury employment, he may very reasonably have assumed that he had no grounds on which to go back to the Tribunal and to ask it to reconsider its decision. What we do know is that Keynes' grave concern regarding the morality and wisdom of compulsory military service was not ephemeral, and that his attitude had not changed substantially before his case came up for hearing.[1]

Thus Keynes' own papers seem to show that, in Mr. Bell's words, he was indeed a conscientious objector to conscription " of a peculiar and, as I think, most reasonable kind." The statement of his views which remains among his papers, even if it was not sent to the Tribunal in precisely that form, unquestionably shows his thinking at this time.[2] As with all else that he wrote, the words are carefully weighed. It is abundantly clear that he was not claiming exemption as a pacifist: he did not argue that there were no conceivable circumstances in which he would voluntarily offer himself for military service. But he was " not prepared on such an issue to surrender my right of decision." His attitude was that of many of the most honest and sincere liberals of the day and reflects a liberal view of the rights of the individual that is almost forgotten to-day.[3]

It all adds up to something different—and perhaps more creditable to Keynes—than a sop to Bloomsbury. It deserves respect and not apology.

ELIZABETH JOHNSON

[1] A letter to Dennis Robertson, dated June 18, 1916, and thus several months after the Tribunal had dealt with his case on March 28, includes the following passage:

> " The Tribunal crisis is getting over now, as concessions to the C.O.'s are impending. But it has been a foul business, and I spend half of my time on the boring business of testifying to the sincerity, virtue and truthfulness of my friends."

[2] It is wholly consistent with his fundamental personal philosophy as described in " My Early Beliefs ":

> " We entirely repudiated a personal liability on us to obey general rules. We claimed the right to judge every individual case on its merits, and the wisdom, experience and self-control to do so successfully . . . we repudiated entirely customary morals, conventions and traditional wisdom . . . we recognised no moral obligation on us, no inner sanction, to conform or to obey. Before heaven we claimed to be our own judge in our own case " (" My Early Beliefs," *Two Memoirs*, pp. 97, 98).

While it professes a special kind of conscientious objection, it is exactly the kind attributed to Keynes by Mr. Bell:

> " He was not a pacifist; he did not object to fighting in any circumstances; he objected to being made to fight. Good liberal that he was, he objected to conscription. He would not fight because Lloyd George, Horatio Bottomley and Lord Northcliffe told him to " (*Old Friends*, pp. 46–7, quoted by Harrod, " Clive Bell on Keynes," *loc. cit.*, p. 696).

[3] Keynes' friend Sir John Simon resigned from Asquith's Cabinet on precisely this issue. He, like many others, volunteered for military service though strongly opposed to conscription either for himself or others.

A COMMENT

GRATITUDE is due to Mrs. Johnson for her diligent research. She has convicted me of two or three inaccuracies in my text, and, more important, of not sufficiently bringing out the passionate fervour of Keynes's objection to conscription.[1] Evidence for this is supplied, *inter alia*, by his draft statement for the Local Tribunal. Whether I missed this, when going through his mountainous files, or saw it, but gave it insufficient weight, I cannot now be sure. In my research into this episode I relied mainly on conversations with friends who had been near him at the time; I pondered over what I learnt for many months before writing. My earnest desire was to set this rather important matter in the right perspective. It was a case where the real significance of a succession of events has to be assessed in the light of one's knowledge of a man's character.

I remain as convinced as I was before that Mr. Bell's statement that Keynes was a " Conscientious Objector to Conscription " needs correction.

My views are summarised as follows:

1. The letter from his mother (my *Life of Keynes*, p. 215), dated on the day after he was due to appear at the Tribunal, proves that he had given her no warning of his intention. As it is unthinkable, in view of their life-long mutual relations, that he would have allowed her to get her first information of this in the newspapers, I infer that at some time *before* he was due to appear, he had abandoned his idea of appearing and therewith of being a so-called " Conscientious Objector to Conscription."

2. It would make no sense not to appear because of an " important meeting," since, if he had appeared on conscientious grounds, he would have had to resign from the Treasury, or, at best, have been kept on for unimportant duties; and he must have known that. Therefore the " important meeting " would not explain his not appearing, if he still wished to do so. But it served very well as an excuse.

3. There is the important statement, quoted by Mrs. Johnson from Dr. Keynes's diary,[2] that he expected that he would stay on " until they begin to torture one of my friends." *Before* he was due to appear before the Tribunal, he had had good news about Lytton Strachey and Mr. James Strachey.[3] If this was taken as an indication of what was likely to befall the others, it removed his stated motive for taking action.

4. The verdict of the Tribunal, in confirming the exemption from military service that he already had, did not change the situation in any way. Accordingly his not seeking to appear at a later date is consistent only with his having abandoned his original idea.

5. " Conscientious Objection to Conscription " is not a very clear idea.

[1] I shall rectify these matters if a new impression is called for.

[2] Page 161 footnote 2.

[3] See letter from Mrs. Keynes, quoted above.

Sir John Simon (later Lord Simon), who may be said to have had such an "Objection," resigned from the Cabinet and joined the army. While a Treasury official could not be deemed responsible for the actions of the Government to the same extent as a Cabinet Minister, this would have been the logical course for Keynes to take, *had he deemed any action needful.* I suggest that his idea of the more spectacular, but less logical, course of appearing before a Tribunal as a "Conscientious Objector to Conscription" was actuated by his ardent desire to share in the "tortures" of his friends, if tortured they were to be, and that his abandonment of this not altogether logical plan was due to the relatively good news about the treatment meted out to them, as well as to further reflection.

6. Accordingly I conclude as follows. If by saying that Keynes was a Conscientious Objector to Conscription, what is meant is the hypothetical proposition that, had he been a member of the Cabinet, he would, like Simon, have resigned, I am sure that that is true. Another hypothetical proposition may well be true, namely that, if the Act had been differently administered, involving brutal treatment for his friends, he would have appeared before the Tribunal as a "Conscientious Objector to Conscription." These hypotheticals are difficult. To say *simpliciter* that he was a "Conscientious Objector to Conscription" is, in my judgment, *untrue.* I suggest that the correct way of describing the matter is to say that for two or three months he entertained the idea of appearing before a Tribunal as a "Conscientious Objector to Conscription," but, before final action was required, abandoned the idea as untenable. And I believe that most people will hold that his earlier impulse, so generous in relation to his friends, and his suppression of it, before final action was required, in the light of the facts and of logic, are *both* to his credit.

R. F. HARROD

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CURRENT TOPICS

THE Annual Meeting of the Royal Economic Society will be held on Thursday July 7 at 5 p.m. at the London School of Economics. The formal business will be followed by a discussion of "Problems of European Trade and Relations."

Frances Wood Memorial Prize. The Council of the Royal Statistical Society offers the Frances Wood Memorial Prize of fifty guineas for competition in 1960. As the object of the Prize is to encourage young investigators, competitors must be under the age of 35 on January 1, 1960. It is hoped that this offer of a Prize will appeal specially to the younger Fellows of the

Society, but it is also open to those who are not Fellows and in particular to members of the Research, Industrial Applications, Medical and General Applications Sections of the Society and of the Local Groups. The Prize is offered for the best investigation, on statistical lines, of any problem, chosen by the competitor, which bears directly or indirectly upon economic or social conditions. Further information should be obtained from the Honorary Sectretaries of the Royal Statistical Society, 21 Bentinck Street, London, W.1.

Previous awards have been:

1921	Winifred Mackenzie	Changes in the Standard of Living of the Working Classes in the United Kingdom between 1860–1914.
1923	E. G. M. Haynes	Human Power in the English Pottery Industry.
1925	Christopher T. Brunner	An Inquiry into Local Variations in the Birth-rate.
1928	Colin G. Clark	A Graphical Analysis of the Unemployment Position, 1920–28.
1932	R. W. B. Clarke	Production, Output per Head, Prices and Costs in the Iron and Steel Industry, 1924–31.
1936	C. V. Dawe	An Economic Interpretation of the Agricultural Statistics relating to the Bristol Advisory Province.
1938	R. Huws Jones	Physical Indices and Clinical Assessments of the Nutrition of Schoolchildren.
1940	H. W. Singer	The Process of Unemployment, statistically analysed.
1946	J. Marley	A Statistical Survey of Certain Aspects of the Beef Producing, Dairying and Cattle Rearing Industries in Great Britain between 1939 and 1947.
	T. Barna	Britain's Manpower Problem in the Next Five Years.
1949	J. L. Nicholson	Variations in Working Class Family Expenditure.
	L. T. Wilkins	The Prevalence of Deafness in England, Scotland and Wales.
1954	A. Barr	Rehabilitating the Tuberculous in Northern Ireland.
1958	David Hewitt	Mortality in the London Boroughs 1950–1952, with Special Reference to Respiratory Diseases.

THE following have been admitted to Life Membership of the Society:

Ghevaria, V. D.
Kobayashe, Kenzo
Kounine, A.
Mayer, T.
Richardson, W.
Roach, J. E. Jnr.
Staley, C. E.
Ta-Chung Lui, Prof.

THE following have been admitted to Fellowship of the Society:

Asimakopulos, A.
Brown, R. D.
Chan, A. Nam Wah
Clark, R. H.
Cole, L. W.
Colmer, K. H.
Coontz, S.
Daniel, C. Glyn
Das, K. K.
Dawe, J. E.
Deltgen, F. M. F.
Desai, I. M.
Dhital, V. P.
Edminster, Miss D.
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Farrer, R. D.
Fernando, P. T. S.
Fieldhouse, R. H.
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Gibson, N. J.
Hanson, E. J.
Harper, R. J.
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Jayasinghe, C. E.
Johnson, A. M.
Johnson, E. E. Jnr.
Khadabux, B. J.
Kinchin, D. H. J.
Kirkland, R.
Kirkman, M. F.
Kukde, N. K.
Kumar, R.
Lingwood, R. L.
Llewellyn, D. J.
Lury, D. A.
Mapstone, G. E.
McDonagh, J. M.
McKee, D.
McKinneley, I.
McLarty, R.
Mirrlees, J. A.
Moore, B.
Mukerji, S. N.
Mukherjee, S. K.
Murray, S. N.
Nwachukwu, A. C. J.
O'Brien, C. P.
O'Halloran, D.
O'Riain, M.
Patnaik, J.
Pratt, F. R.
Rademan, C. F. O.
Rao, B. Ramachandra
Shannon, Prof. R. E.
Shears, D. F.
Singh, Prof. D. Bright
Smith, John Brian
Sreeramullu, C.
Terrell, R. D.
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Uchay, J. O.
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Walker, Dr. K. R.
Walker, R.
Wilkinson, R. K.
Winch, D. N.
Wise, T. F.
Yamane, Taro
Yoshio, Katsura

THE following have been admitted to Library Membership of the Society:

Agricultural Economics Department, King's College, Newcastle-on-Tyne.

Faculdad de Ciencas Economicas, Instituto de Economicas y Finanzas, Cordoba, Argentina.

Industrial Development Corporation of South Africa, Ltd., Johannesburg, S. Africa.

National Bank of Libya, Economic Research Department, Benghazi, Libya.

Wirtschaftswissensch. Seminar der Christian-Albrechts-Universitat, Kiel, Germany.

RECENT PERIODICALS AND NEW BOOKS

Journal of the Royal Statistical Society

VOL. 122, PART 2, 1959. *The Determinants of Wage Inflation; United Kingdom, 1946–56:* L. A. DICKS-MIREAUX and J. C. R. DOW. *Production and Productivity Movements in the United Kingdom since 1900:* K. S. LOMAX. *Using an Electronic Computer in a Problem of Medical Diagnosis:* T. H. HOLLINGSWORTH. *Note on the Measurement and Prediction of Labour Turnover:* D. J. BARTHOLOMEW.

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VOL. XXVI, NO. 104, NOVEMBER 1959. *Economic Growth and the Problem of Inflation: II:* N. KALDOR. *The Relation Between Unemployment and the Rate of Change of Money Wage Rates: A Comment:* G. ROUTH. *Welfare Economics, Ethics, and Essentialism:* G. C. ARCHIBALD. *Underemployment in Agriculture and the Industrial Wage Rate:* D. MAZUMDAR. *Horsley Palmer on Bank Rate:* A. B. CRAMP. *A Theorem on Undercompensated Price Changes:* M. MCMANUS.

CONSOLIDATED INDEX. New Series, Volumes I–XXV, 1934–1958.

The Review of Economic Studies

VOL. XXVII, NO. 72, OCTOBER 1959. *Some Notes on Stability Conditions:* P. NEWMAN. *A Note on Crawling Along the Ceiling:* R. C. O. MATTHEWS. *Interrelated Industries and the Rate of Technological Change:* W. P. STRASSMANN. *Capital Levies in Western Europe after the Second World War:* P. ROBSON. *Investment Allowances, Initial Allowances and Cheap Loans as Means of Encouraging Investment:* J. BLACK. *Cash Circulation in the Planned Economies of Eastern Europe:* J. BARACS. *A View of the Aggregation Problem:* M. H. PESTON.

Oxford Economic Papers

VOL. II, NO. 3, OCTOBER 1959. *Adam Smith's Moral Sentiments as Foundation for his Wealth of Nations:* A. L. MACFIE. *Non-pecuniary Elements and Business Behaviour:* J. H. DUNNING. *Investing in Coal:* D. L. MUNBY. *Trends, Cycles, and Stagnation in U.S. Manufacturing since 1860:* E. AMES. *Economies of Scale in Road Goods Transport?: Off-farm Milk Collection in England and Wales:* M. CHISHOLM. *Ex Ante and Ex Post Propensity to Consume:* H. NEISSER. *Notes on "Unbalanced Growth":* R. NURKSE.

Transactions of the Manchester Statistical Society

126TH SESSION, 1958–59. *The Changing Balance of Fuel and Power:* C. I. K. FORSTER. *Post-war Agricultural Policy in the United Kingdom:* W. J. THOMAS. *The Development of Mechanical Sorting in the Post Office:* K. S. HOLMES. *Investment in the Nationalised Industries:* S. R. DENNISON. *The International Liquidity Problem:* A. C. L. DAY.

The Manchester School of Economic and Social Studies

VOL. XXVII, NO. 3, SEPTEMBER 1959. *Probability and Economic Decision Taking:* M. B. NICHOLSON. *International Trade, Income Distribution and the Offer Curve:* H. G. JOHNSON. *Periodicity and Stability of Inventory Cycles in the U.S.A. (II):* D. J. COPPOCK. *Cycles, Accumulation and the Growth of Capacity:* J. K. WHITAKER. *A Monthly Index of Wage-rates by Industries:* J. R. CROSSLEY.

Scottish Journal of Political Economy

VOL. VI, NO. 3, NOVEMBER 1959. Special Number on Regional Economic Problems. *Wales and the Atlantic Economy:* B. THOMAS. *Employment and Unemployment in Regions and in the Development Areas:* J. SYKES. *Local Unemployment and the 1958 Act:* A. J. ODBER. *Regional Input–Output Analysis and Government Spending:* A. T. PEACOCK and D. G. M. DOSSER. *Purchases by Public Authorities in Scotland:* J. VEVERKA.

London and Cambridge Economic Bulletin

NEW SERIES NO. 32, DECEMBER 1959. *The Economic Position. The Radcliffe Report and Domestic Monetary Policy:* R. F. G. ALFORD and H. B. ROSE. *The European Free Trade Association:* A. C. L. DAY. *Quarterly Income and Expenditure:* C. H. FEINSTEIN. *Prices and Wages:* R. G. D. ALLEN and H. S. BOOKER. *International Finance:* A. C. L. DAY.

Bulletin of the Oxford University Institute of Statistics

VOL. 21, NO. 3, AUGUST 1959. *Innovation and Automation: A Discussion based on Case Studies:* F. R. EELS, A. D. HAZLEWOOD, K. G. J. C. KNOWLES and C. B. WINSTEN.

National Institute Economic Review

NO. 6, NOVEMBER 1959. *The Economic Situation. Trends in World Trade in Durable Consumer Goods. A Review of Soviet Economic Progress:* A. NOVE.

The Journal of Industrial Economics

VOL. VIII, NO. 1, OCTOBER 1959. *Discriminatory Pricing as a Barrier to Entry: The Spark Plug Litigation:* A. H. KAHN. *A Critique of United States Experience with Price-fixing Agreements and the Per Se Rule:* A. PHILLIPS. *Restrictive Practices in the Food Trades:* N. CUTHBERT. and W. BLACK. *The Restrictive Practices Court and Cotton Spinning:* A. SUTHERLAND. *Accelerated Depreciation Allowances and Industrial Investment:* D. P. BARRITT.

The Economic History Review

VOL. XII, NO. 2, DECEMBER 1959. *The Economic and Social Development of the Baltic Countries from the Fifteenth to the Seventeenth Centuries:* M. MALOWIST. *Evidences of Industrial Growth on Some Fifteenth-century Manors:* E. M. CARUS-WILSON. *Trade through the Sound in the Seventeenth and Eighteenth Centuries:* W. S. UNGER. *The Miners and the Eight-hour Day, 1863–1910:* B. MCCORMICK and J. E. WILLIAMS.

International Affairs

VOL. 36, NO. 1, JANUARY 1960. *Disarmament, Europe, and Security:* A. NUTTING. *Japanese Foreign Policy and Neutralism: I:* I. MORRIS. *Impressions of the United Arab Republic:* N. BARBOUR. *Tanganyika Today: I: The Background:* C. C. HARRIS; *II: The Nationalist View:* J. NYERERE. *Dictatorship and Democracy in Latin America:* R. H. FITZGIBBON. *The Syrian Crisis of 1957—Fact and Fiction:* G. KIRK. *Progress in the Codification of International Law:* F. HONIG.

The British Journal of Sociology

VOL. X, NO. 4, DECEMBER 1959. *The Impact of National Service:* T. FERGUSON and J. CUNNISON. *Social Life in a Provincial University:* A. EDEN. *A Public Language:* B. BERNSTEIN. *Some Psycho-Social Aspects of British Emigration to Australia:* A. RICHARDSON. *Motivation of a Totalitarian Mass Vote:* W. B. SIMON. *Social Stratification and "Right-wing Extremism":* S. M. LIPSET.

The Sociological Review

VOL. 7, NO. 2, DECEMBER 1959. *Social Behaviour in Small Work Groups:* E. M. MUMFORD. *Some Points of Reinterpretation Regarding Social Conformity:* E. P. HOLLANDER. *Middle Class Families and Schools, 1780–1880:* F. MUSGROVE. *The Leader–Follower Relationship:* T. E. STEPHENSON. *An Account of Religious Sociology in France:* M. JACKSON. *Employment and the Journey to Work in an Overspill Community:* H. B. RODGERS. *West German City Reconstruction: Two Case Studies:* E. T. GREENE.

Journal of the Institute of Actuaries

VOL. 85, PART II, NO. 370, 1959. *Developments in Investment Policy during the Last Decade:* J. G. DAY. *A Statistical Review of the Evidence for the Existence of Temporary Selection:* H. L. SEAL. *The Expenses of British Life Offices:* E. J. W. DYSON and M. D. W. ELPHINSTONE. *National Pensions: Memoranda to the Minister of Pensions and National Insurance by the Councils of the Institute of Actuaries and the Faculty of Actuaries in Scotland; An Appeal to Statesmanship: A Booklet issued by the Councils of the Institute of Actuaries and the Faculty of Actuaries in Scotland.*

VOL. 85, PART III, NO. 371, 1959. *The Valuation of Annuity Business:* J. A. WESTCOTT and E. M. SMITH. *The Theory of Games and its Application to Rate of Interest:* B. BENJAMIN. *The Recent Trend of Morality in Great Britain:* L. V. MARTIN.

British Tax Review

SEPTEMBER–OCTOBER 1959. *Earned Income of a Married Woman:* G. S. A. WHEATCROFT. *How Income Tax Came Home to Roost:* W. PHILLIPS. *Accounting Profits and Tax Profits:* S. T. CRUMP. *United Kingdom–Eire Double Taxation Agreements and Assessments: II:* G. C. MASON. *European Fiscal Systems: Western Germany:* E. B. NORTCLIFFE.

The Farm Economist

VOL. IX, No. 5, 1959. *A Review of the Nitrogen Fertilizer Industry and United Kingdom Agriculture:* O. T. W. PRICE. *The Marketing of Fresh Fruit and Vegetables Grown in Great Britain:* R. L. SMYTH. *A Footnote to the Controversy Concerning the Productivity of Concentrates in Feeding Dairy Cows:* T. W. GARDNER. *A Study of the Ways in which the First Dairy Farmers to Take up a New Technique Came to Hear about It:* D. SHEPPARD. *Some Economic Contradictions in Government Small-holdings Policy:* E. A. ATTWOOD. *The Economics of the Use of Selective Weedkillers:* P. M. HILLEBRANDT.

The Banker

VOL. 109, No. 405, NOVEMBER 1959. *A Government Fit for Businessmen?:* J. E. HARTSHORN. *Sterling Policy Now:* P. BAREAU. *Disowning Canada's Dear Money:* E. P. NEUFELD. *Control by "Stickiness" of Rates?:* J. SPRAOS. *The Peseta through Spanish Eyes:* L. OLARIAGA.

VOL. 109, No. 406, DECEMBER 1959. *Defending the Dollar. A Squeak from Aunt Sally:* SIR DENNIS ROBERTSON. *The New Data—and Their Uses:* C. T. SAUNDERS. *Customer for Change?:* J. E. HARTSHORN. *Reforming the Truck Acts.*

VOL. 110, No. 407, JANUARY 1960. *Dearer Money Ahead? Improving World Liquidity:* R. TRIFFIN. *Dollar Deposits in London:* P. EINZIG. *A Case for Financial Controls?:* B. TEW. *New Zealand Returns to Inflation:* J. W. ROWE.

The Bankers' Magazine

VOL. CLXXXVIII, No. 1388, NOVEMBER 1959. *Economic Policy after the Election. Survey of Economic Conditions in the U.S.A.: Interest Rates, Steel Shortage, and Compact Cars. New Methods in Banking:* R. HINDLE. *Some Characteristics of Banking in France:* M. MITZAKIS. *Some Characteristics of Banking in Italy:* E. BOMPARD.

VOL. CLXXXVIII, No. 1389, DECEMBER 1959. *Politics and the European Trade Areas:* N. MOMTCHILOFF. *The City and the Radcliffe Report:* C. F. COBBOLD. *Survey of Economic Conditions in the U.S.A.: A Period of Uncertainty in Steel. The Deutschemark Problem:* W. M. SCAMMELL. *Some Characteristics of Banking in Turkey:* H. KAYNAR.

VOL. CLXXXIX, No. 1390, JANUARY 1960. *The Banking Year. Survey of Economic Conditions in the U.S.A.: Year-end Review and Outlook for 1960. Stock Exchange Security Values: The Year's Markets:* M. RIX. *Radcliffe Report: A Socratic Scrutiny:* W. T. NEWLYN. *Some Characteristics of Banking in Denmark:* E. KROGSTRUP. *Some Characteristics of Banking in Norway:* J. K. SAEVIL.

Barclays Bank Review

VOL. XXXIV, No. 4, NOVEMBER 1959. *Has Inflation Been Cured?:* A. TUKE. *The European Scene. Widening Outlooks at the Bank and Fund.*

District Bank Review

No. 132, DECEMBER 1959. *Progress by Policy:* G. HUTTON. *Cotton under Scrutiny:* W. G. PILKINGTON. *The Flow of International Capital.*

Lloyds Bank Review

No. 54, OCTOBER 1959. *The Radcliffe Report:* R. V. ROOSA. *Equities and Growth:* T. WILSON. *Wage Flexibility and the Distribution of Labour:* W. B. REDDAWAY.

No. 55, JANUARY 1960. *Treasury Bills and the Money Supply:* W. MANNING DACEY. *The New Attack on Localized Unemployment:* A. T. PEACOCK and D. G. M. DOSSER. *Industrial Relations in an Affluent Society:* B. C. ROBERTS.

Midland Bank Review

NOVEMBER 1959. *The Radcliffe Report and the Banks. Britain's Shops and Shoppers. Islands in the Sun.*

National Provincial Bank Review

No. 48, November 1959. *Thoughts on the Agricultural Revolution:* J. T. Beresford. *Man-made Timber—Wood Chipboard:* F. C. Lynam.

The Three Banks Review

No. 44, December 1959. *The Present Economic Position of Great Britain:* C. F. Carter. *Consumer Credit and the Tally Man:* L. C. Wright. *Houses Long Ago.*

Westminster Bank Review

November 1959. *Radcliffe Report: An Important Document; Is the Money Supply Important?:* Sir Roy Harrod; *In Search of Guidance:* J. S. G. Wilson; *An American Impression:* A. I. Bloomfield.

Planning

Vol. XXV, No. 437, November 1959. *The British Shipping Industry.*
Vol. XXVI, No. 438, January 1960. *America and the Welfare State:* D. Wilson.

Which?

October 1959. Reports on Detergents, Sugar, Ballpoint Pens.
November 1959. Reports on Electric Tools, Shampoos, Bird Seed, 35-mm. Cameras.
January 1960. Reports on Comparative Heating Costs, Sunlamps, Matches, Fibres and Fabrics.

The Journal of the Institute of Transport

Vol. 28, No. 7, November 1959. *Transport—The Mainspring of Progress:* R. G. Grout. *Transport in Denmark:* F. P. Pedersen. *World Peace through Air Transportation:* E. Rickenbacker.

Steel Review

No. 16, October 1959. *Revolution in Steelmaking. New Life in the Valleys:* F. Evans. *Recent Developments in Structural Steelwork:* D. H. Lee and R. McEwing.
No. 17, January 1960. *British Steel in 1960. France Looks Forward:* R. Aron. *France: Her Economy and Ours. France: Her Steel Industry. Battle of the Baby Cars.*

Hard Fibres

No. 35, December 1959. *World Situation. Price Trends in 1959. Trends in German Sisal.*

Progress (Unilever)

Vol. 47, No. 263, Summer–Autumn 1959. *What Unilever Is. Portugal's Six-Year-Plans for Development:* J. Ferreira Dias. *World Refugee Year:* C. Chataway. *Drawing the "Teeth of the Wind": Locust Control and Research:* P. Collins. *The Revolution in Food Distribution in America:* F. J. Lunding. *An Agricultural Policy for the European Economic Community:* S. Mansholt. *The Administrative Staff College of India:* K. T. Chandy. *The Value of Advertising:* R. Harris.

Statistical and Economic Review (United Africa Company)

No. 23, September 1959. *Industrialization in West Africa. Cocoa Buying and Ferries in Ghana.*

The Economic Record

Vol. XXXV, No. 71, August 1959. *The Australian Economy—1965:* B. Cameron. *The Attempted Nationalisation of Banks in Australia, 1947:* M. G. Myers. *The Conditions for Oligopolistic Price Interdependence:* R. O. Hieser. *The Equality of Replacement and Depreciation:* W. Hogan. *Inventory Analysis and the Economics of Fodder Conservation:* J. L. Dillon and R. G. Mauldon. *Problems of Duopoly and the Theory of Games:* W. T. Dowsett. *Internal and External Balance: The Role of Price and Expenditure Effects:* W. E. G. Salter.

The Australian Journal of Agricultural Economics

VOL. 3, No. 1, JULY 1959. Proceedings of the Third Conference of the Australian Agricultural Ecomics Society, Melbourne, February 1959. *Australian Trade Policy: Comment and Question:* SIR JOHN CRAWFORD. *Some Aspects of the Supply of Agricultural Products:* G. O. GUTMAN. *Symposium on Extension: Economics in Australian Agricultural Extension Services:* D. B. WILLIAMS; *The Contribution of Sociology to Effective Agricultural Extension:* H. FALLDING. *A New Look at Budgeting from the Standpoint of Linear Programming:* W. V. CANDLER. *Rural Credit Developments in Australia:* H. C. COOMBS. *U.K. Agricultural Policy and the Australian Farm Programme:* SIR SAMUEL WADHAM.

The South African Journal of Economics

VOL. 27, No. 3, SEPTEMBER 1959. *Aspects of Economic Growth with Special Reference to South Africa:* C. G. W. SCHUMANN. *Some Aspects of Industrial Development in South Africa:* L. H. SAMUELS. *Liquidity in the Banking System of the Federation of Rhodesia and Nyasaland, 1954 to 1958:* E. OSBORN. *Economic Trends in the Union, 1958/9:* M. H. DE KOCK. *Economic Aspects of Future Power Supplies in the Federation of Rhodesia and Nyasaland:* J. H. WEST. *Urbanization and Economic Progress in Nigeria:* J. HEADS.

Finance and Trade Review (Volkskas Ltd.)

VOL. III, No. 6, SEPTEMBER 1959. *Trends in International Trade and Future Prospects:* M. D. MARAIS. *The South African Textile Industry. The Development and Structural Changes in the Union of South Africa's Distributive Trade:* G. MARAIS. *Address Delivered by the Governor of the South African Reserve Bank:* M. H. DE KOCK.

The Canadian Journal of Economics and Political Science

VOL. 25, No. 4, NOVEMBER 1959. *Sociology, History, and the Problem of Social Change:* S. D. CLARK. *The Dual Mandate of Social Science:* E. C. HUGHES. *Capital Accumulation, Technological Change and Economic Growth:* M. C. URQUHART. *Depreciation in Disequilibrium:* M. C. KEMP. *Some Technical Factors in the Production and Marketing of Canadian Wheat:* G. N. IRVINE and J. A. ANDERSON. *The Development of a Capitalistic Labour Market in Canada:* H. C. PENTLAND. *Parliamentary Privilege in the Canadian House of Commons:* W. F. DAWSON. *Inflation in the Context of a Mixed Economy:* R. SOLO. *Political Tendencies and Parties in Germany:* R. HEBERLE.

The Indian Economic Journal

VOL. VII, No. 1, JULY 1959. *Risk, Incentive and the Technique of Low-income Farmer:* R. C. PORTER. *Monetary Policy in an Inflationary Economy:* MANMOHAN SINGH. *Money, Banking and Credit in New Zealand:* H. N. PATHAK. *Nationalisation of Broadcasting in India:* J. V. S. RAMASASTRI. *Bank Financing of Consumer Instalment Credit:* K. D. DOODHA.

Sankhyā

VOL. 21, PARTS 3 and 4, 1959. *The Analysis of Heterogeneity: I:* J. B. S. HALDANE. *Sufficient Statistics of Minimal Dimension:* EDWARD W. BARANKIN and MELVIN KATZ. *The Family of Ancillary Statistics:* D. BASU. *Metricizing Rank-ordered or Unordered Data for a Linear Factor Analysis:* LOUIS GUTTMAN. *Positive and Negative Dependence of Two Random Variables:* H. S. KONIJN. *Definition and Use of Generalized Percentage Points:* JOHN E. WALSH. *Joint Asymptotic Distribution of V-statistics and Order Statistics:* J. SETHURAMAN and B. V. SUKHATME. *Some Sampling Systems Providing Unbiased Ratio Estimators:* N. S. NANJAMMA, M. N. MURTHY and V. K. SETHI. *Tables for Some Small Sample Tests of Significance for Poisson Distributions and 2 × 3 Contingency Tables:* I. M. CHAKRAWARTI and C. RADHAKRISHNA RAO. *Expected Values of Mean Squares in the Analysis of Incomplete Block Experiments and Some Comments Based on Them:* C. RADHAKRISHNA RAO. *Some Remarks on the Missing Plot Analysis:* SUJIT KUMAR MITRA. *The Use of Linear Algebra in Deriving Prime Power Factorial Designs with Confounding and Fractional Replication:* N. T. J. BAILEY. *Properties of the Invariant I_m (m-odd) for Distributions Admitting Sufficient Statistics:* B. RAJA RAO. *Numerical Evaluation of Certain Multivariate Normal Integrals:* PETER IHM. *On the Evaluation of the Probability Integral of a Multivariate Normal Distribution:* S. JOHN. *The Distribution of Wald's Classification Statistic when the Dispersion Matrix Is Known:* S. JOHN. *An Extension of Hald's Table for the One-sided Censored Normal Distribution:* NIKHILESH

BHATTACHARYA. *Almost Unbiased Ratio Estimates Based on Interpenetrating Sub-samples:* M. N. MURTHY and N. S. NANJAMMA. *Precision in the Construction of Cost of Living Index Numbers:* K. S. BANERJEE. *Price Indexes and Sampling:* E. v. HOFSTEN.

Pakistan Economic Journal

VOL. IX, No. 2–3, JULY–SEPTEMBER 1959. *Report of the All Pakistan Ninth Annual Economic Conference.*

The Malayan Economic Review

VOL. IV, No. 2, OCTOBER 1959. *Group Behaviour of Multi-product Firms: Large Numbers:* S. J. GILANI. *The Teaching of Economics in Southeast Asia:* C. R. WHARTON; *A Reply:* T. H. SILCOCK. *A Note on the Monetary Controversy in Malaya:* T. BALOGH. *Company Profits and Prices in the Rubber Industry in Malaya, 1497–58:* R. MA. *The Marketing of Tin-ore in Kampar:* YIP YAT HOONG. *The Population Growth of Singapore:* YOU POH SENG. *Some Aspects of Income Taxation in Viet-Nam:* M. C. TAYLOR.

The National and Grindlays Review

VOL. 5, No. 4, OCTOBER 1959. *Sterling System under Scrutiny. New World Coffee Pact.*
VOL. 6, No. 1, JANUARY 1960. *New Pattern for Aid and Investment. China's Challenge in Cotton Textiles:* B. MORTIMER.

Social and Economic Studies

VOL. 8, No. 3, SEPTEMBER 1959. *The Economy of Antigua:* C. O'LOUGHLIN. *Foreign Aid and Economic Development:* NURUL ISLAM. *Tourist Expenditure in Jamaica, 1958:* G. E. CUMPER.

The Irish Banking Review

SEPTEMBER 1959. *The Report of the Central Bank. Some Aspects of the Development of Irish Manufacturing Industry. The State and Industrialisation:* SIR HUGH BEAVER.

International Labour Review

VOL. LXXX, No. 5, NOVEMBER 1959. *Reform of Vocational Training in Switzerland:* E. JEANGROS. *Wage Negotiations and Wage Policies in Sweden: II. British Wages Councils and Full Employment:* F. J. BAYLISS.
VOL. LXXX, No. 6, DECEMBER 1959. *Wages in Viet-Nam. Vocational and Technical Training in the U.S.S.R.:* H. ZELENKO. *Vocational Guidance in Belgium.*
VOL. LXXXI, No. 1, JANUARY 1960. *From Compulsory Arbitration to Collective Bargaining in the Philippines:* C. D. CALDERON. *Agricultural Policy in Scandinavian Countries. The Swiss Federal Act on Invalidity Insurance:* A. SAXER. *Technical and Scientific Personnel: Methods of Assessing Supply and Demand. The Motives of Emigration: Findings of a Recent Study in the Netherlands.*

International Financial Statistics

VOL. XII, No. 11, NOVEMBER 1959. Usual statistical material.
VOL. XII, No. 12, DECEMBER 1959. *Revised Money and Banking Statistics for Bolivia. New Table on European Fund.* Usual statistical material.
VOL. XIII, No. 1, JANUARY 1960. *An Introduction to IFS.* Usual statistical material.

International Monetary Fund Staff Papers

VOL. VII, No. 2, OCTOBER 1959. *The Theory and Use of Financing Accounts:* E. HICKS. *Balance Sheets in a System of Economic Accounts:* G. S. DORRANCE. *A Monetary Budget:* H. M. KNIGHT. *The Relation between Long-term and Short-term Interest Rates in the United States:* R. GOODE and E. A. BIRNBAUM. *Fluctuating Exchange Rates in Countries with Relatively Stable Economies: Some European Experiences after World War I:* S. C. TSIANG. *Central Bank Policies and Inflation: A Case Study of Four Less Developed Economies, 1949–57:* J. AHRENSDORF. *The Relation between Inflation and Economic Development: A Statistical Inductive Study:* U TUN WAI.

United Nations Economic Bulletin for Europe

VOL. 11, NO. 3, 1959. *Current Economic Developments in Europe. A Note on Some Aspects of National Accounting Methodology in Eastern Europe and the Soviet Union.*

Econometrica

VOL. 27, NO. 3, JULY 1959. *Consommation en Prix et Revenu Réels et Théorie des Choix:* C. FOURGEAUD and A. NATAF. *An Analysis of the Distribution of Wages and Salaries in Great Britain:* T. P. HILL. *The Simplex Method for Quadratic Programming:* P. WOLFE. *Centralization and Decentralization in Economic Organizations:* T. MARSCHAK. *Generalization of the Rank and Order Conditions for Identifiability:* F. M. FISHER. *Prices of the Factors of Production in International Trade:* H. UZAWA. *Separable Utility and Aggregation:* W. M. GORMAN. *The Utility Tree: A Correction and Further Appraisal:* R. H. STROTZ. *The Empirical Implications of a Utility Tree: A Further Comment:* W. M. GORMAN.

Public Finance

VOL. XIV, NO. 2, 1959. *Les mesures fiscales propres à favoriser les investissements:* N. NESI and F. SAVERIO SEGANTI. *On the Obsolescence of Incidence:* J. A. STOCKFISCH. *Counter-inflationary Fiscal, Monetary and Direct Control Measures in an Under-developed Country:* S. GHOSH. *The Shifting, Incidence and Effects of the Corporate Net Income Tax in a Macroeconomic Setting:* G. N. ROSTVOLD.

Kyklos

VOL. XII, NO. 4, 1959. *The Limitations of Economic Growth Models:* K. W. ROTHSCHILD. *River Valley Development Projects: Problems of Evaluation and Social Costs:* K. W. KAPP. *Diminishing Class Differentials in the United States:* K. MAYER. *Distribution, Demand, and Equilibrium in International Trade: A Diagrammatic Analysis:* P. B. KENEN. *Das Handwörterbuch der Sozialwissenschaften:* W. WEBER. *Economic Forecasting:* L. R. KLEIN. *The Strategy of Economic Development:* J. H. ADLER. *Demography and the Study of Population:* G. SOTIROFF.

The American Economic Review

VOL. XLIX, NO. 5, DECEMBER 1959. *Choosing Among Alternative Public Investments:* P. O. STEINER. *Relative Income Shares in Fact and Theory:* I. B. KRAVIS. *Manufacturers' Inventory Investment, 1947–58:* P. G. DARLING. *Planning with Material Balances:* J. M. MONTIAS. *Competition and Growth: Western Germany:* E. SOHMEN. *Man–Land Equalization through Migration:* F. T. BACHMURA.

The Annals of the American Academy of Political and Social Science

VOL. 326, NOVEMBER 1959. *Inflation.*

The Quarterly Journal of Economics

VOL. LXXIII, NO. 4, NOVEMBER 1959. *Science and Welfare in Economic Policy:* F. ZEUTHEN. *The Politics of Political Economists:* G. STIGLER. *Financial Intermediaries and Monetary Controls:* W. L. SMITH. *On "The Methodology of Positive Economics":* E. ROTWEIN. *Trends in International Trade:* J. H. RICHTER. *Usher and Schumpeter on Invention, Innovation, and Technological Change:* V. W. RUTTAN. *Labor Hiring Policies and Monopolistic Competition Theory:* B. MCCORMICK. *State and Regional Payments Mechanisms:* J. C. INGRAM. *Underutilized Resources, "Directed Demand" and Deficit Financing:* S. P. SCHATZ. *Puerto Rico: An Evaluation of a Successful Development Program:* W. BAER.

The Journal of Political Economy

VOL. LXVII, NO. 5, OCTOBER 1959. *Utility, Risk, and Linearity:* G. C. ARCHIBALD. *Changes in Labor Inputs in Soviet Agriculture:* A. KAHAN. *Inflation and the Price Mechanism:* H. WOLOZIN. *Formal Criteria for Investment Decisions:* M. J. BAILEY. *The Tata Steel Strike: Some Dilemmas of Industrial Relations in a Developing Economy:* S. KANNAPPAN.

VOL. LXVII, NO. 6, DECEMBER 1959. *Labor Mobility, Unemployment, and Economic Change: An Indian Case:* R. C. JAMES. *Maintenance Costs and Economic Development:* R. C. BLITZ. *Problems of Majority Voting:* G. TULLOCK. *Bank Earnings and the Competition for Savings Deposits:* D. CARSON. *The Structure of Saving and the Consumption Function in Post-war Japan:* M. SHINOHARA.

The Review of Economics and Statistics

VOL. XLI, NO. 4, NOVEMBER 1959. *Recent Productivity Trends in the Federal Government: An Exploratory Study:* H. D. LYTTON. *Interindustry Relations of a Metropolitan Area:* W. Z. HIRSCH. *The Public Debt Reconsidered:* A. H. HANSEN. *Changes in the Share of Wealth Held by Top Wealth-holders, 1922–56:* R. J. LAMPMAN. *Welfare, Income, and Budget Needs:* M. DAVID. *An Analysis of the Nature of Aggregates at Constant Prices:* W. W. FLEXNER. *A Bias in the Seasonally Adjusted Unemployment Series and a Suggested Alternative:* T. A. BRITTAIN. *The Measurement of Employment Cost and Prices in the Steel Industry:* H. R. WOOD. *Analysis of Used Car Purchases:* M. E. KREININ.

The Southern Economic Journal

VOL. XXVI, NO. 2, OCTOBER 1959. *Statics and Dynamics: Kaleidoscopic Words:* F. MACHLUP. *Market Classification Systems in Theory and Policy:* R. W. PFOUTS and C. E. FERGUSON. *Patinkin on Neo-Classical Monetary Theory: A Critique in Walrasian Specifics:* R. E. KUENNE. *Technological Change in the Textile Industry:* C. D. CLARK and B. M. OLSEN. *Long Run Prospects of Southern Agriculture:* J. M. BREWSTER. *A "New" Concept in Wage Determination: Disguised Productivity Analysis:* E. E. LIEBHAFSKY.

VOL. XXVI, NO. 3, JANUARY 1960. *Southern Tradition and Regional Economic Progress:* W. H. NICHOLLS. *"Cost Inflation" Versus "Demand Inflation": A Useful Distinction?:* W. G. BOWEN. *The Canadian Exchange Rate, 1950–57:* J. C. INGRAM. *Credit Availability, Interest Rates, and Monetary Policy:* J. GUTTENTAG. *A Reformation of Keynesian Wage Theory:* R. PERLMAN.

Industrial and Labor Relations Review

VOL. 13, NO. 2, JANUARY 1960. *Function of the Mediator in Collective Bargaining:* A. S. MEYER. *Trends in Soviet Occupational Wage Differentials:* M. YANOWITCH. *The Local Union in Soviet Industry: Its Relations with Members, Party and Management:* EMILY C. BROWN. *Organizational Rivalry among American Unions:* J. KRISLOV. *Legal Enforcement of Union Security in Australia:* R. M. MARTIN. *Labor and Antitrust Action:* D. G. BRICKNER.

The Journal of Economic History

VOL. XIX, NO. 2, JUNE 1959. *The Legal System and Economic Development of Greece:* A. A. PEPELASIS. *The Great Depression in Britain, 1873–1896: A Reappraisal:* A. E. MUSSON. *Interpretations of the Industrial Revolution in England: A Methodological Inquiry:* R. M. HARTWELL. *Business Entrepreneurs, Their Major Functions and Related Tenets:* G. HEBERTON EVANS.

VOL. XIX, NO. 3, SEPTEMBER 1959. *Creative Destruction and Partial Obsolescence in American Economic Development:* W. P. STRASSMANN. *Japanese Capital Formation: The Role of the Public Sector:* H. ROSOVSKY. *The Social Interpretation of the English Revolution:* P. ZAGORIN. *Sequential Growth, the Labor-Safety-Valve Doctrine and the Development of American Unionism:* G. G. S. MURPHY and A. ZELLNER.

Review of Social Economy

VOL. XVII, NO. 2, SEPTEMBER 1959. *Justice and Welfare Economics:* S. WORLAND. *Economics of Affluence:* C. A. ZEBOT. *Present-day Applications of Graham's Theory of International Values:* H. G. BRAINARD. *Japanese Consumption, External Disequilibrium and their Statistical Measurement:* A. O. SHARRON. *The Role of Quantitative Thinking in Modern Economic Theory:* V. NIKSA.

Economic Geography

VOL. 36, NO. 1, JANUARY 1960. *Evaluating Store Sites and Determining Store Rents:* S. B. COHEN and W. APPLEBAUM. *A Map of the U.S.S.R.'s Manufacturing:* R. E. LONSDALE and J. H. THOMPSON. *The Hard Core of Cape Town's Central Business District: An Attempt at Delimitation:* D. H. DAVIES. *The Oklahoma Panhandle: A Cross Section of the Southern High Plains:* A. H. DOERR and J. W. MORRIS.

The Journal of Accountancy

VOL. 108, NO. 5, NOVEMBER 1959. *Depreciation in Accountants' Reports:* C. MELVOIN. *Statistical Sampling in Internal Auditing:* J. B. CRAIG. *Income and Expense Planning:* B. J. BELDA. *Accounting Needs for Local Government:* R. L. LEONARD.

VOL. 108, No. 6, DECEMBER 1959. *An Industry View of Budgeting:* R. W. LEWIS. *Challenges to the Accounting Profession in the U.S.:* C. G. BLOUGH. *Changes in Accounting Method:* C. H. GRIFFIN. *Creative Accounting Pays Its Way:* A. J. BOWS. *Management Services for Small Clients:* C. A. LEWIS.

VOL. 109, No. 1, JANUARY 1960. *Standards of Responsibility of CPAs in Tax Practice:* M. E. RICHARDSON. *International Challenges for Accounting:* J. KRAAYENHOF. *The Changing Role of the Controller:* D. L. HAMILTON.

Revue d'Économie Politique

VOL. 69, No. 6, NOVEMBER–DECEMBER 1959. *La théorie économique spatiale et les principes de la politique régionale:* F. VITO. *La restauration de la théorie quantitative de la monnaie par Don Patinkin:* J. MARCHAL. *L'équilibre de la monnaie:* B. SCHMITT.

Revue Économique

VOL. X, No. 6, NOVEMBER 1959. *Le temps et l'espace dans le comportement économique:* R. VUARIDEL. *Expériences récentes de quasi-intégration:* J. HOUSSIAUX. *Utilité du savoir économique dans les affaires:* J. B. ROUELLE. *La circulation fiduciaire de 1954 à 1958:* P. BERGER and L. CASSAGNES. *Perspectives du développement économique de l'Algérie:* A. COTTA.

VOL. XI, No. 1, JANUARY 1960. *La "croissance" dans le Pays de Montbéliard:* R. GOETZ-GIREY. *Fluctuations cycliques dans les transports maritimes:* P. LÉONARD. *D'une forme récente de concentration commerciale:* F. CARRIÈRE. *Le Bilan du Trésor:* J. BILLY. *Evolution de l'emploi aux Etats-Unis:* Y. CHAIGNEAU.

Économie Appliquée

VOL. XII, No. 1–2, JANUARY–JUNE 1959. Profit et Croissance, III. *Croissance balancée ou non balancée?:* T. SCITOVSKY. *Note pour le lecteur français sur l'article du Professeur Scitovsky:* F. PERROUX. *Prix, profit et développement économique: problèmes de l'optimum global:* C. GRUSON. *Intérêt, profit et accumulation du capital:* B. S. KEIRSTEAD. *Taux relatifs de profit:* J. DOWNIE. *Variations du taux de profit et accroissement de la productivité du travail:* C. BETTELHEIM. *Réflexions sur la sous-consommation:* P. BARAN. *Croissance et créations économiques collectives:* L. BUQUET. *La croissance économique des petites nations:* S. KUZNETS. *Possibilisme et pôles de croissance: phénomènes de prestige et de propagation dans le cadre de l'industrialisation néerlandais:* J. PAELINCK. *Fluctuations et croissance économique en France (1820–1952):* A. G. HART. *Une théorie générale du développement économique est-elle concevable?:* J. ÅKERMAN. *Après le succès du capitalism—où allons-nous?:* E. HEIMANN.

Revue de Science Financière

VOL. LI, No. 4, OCTOBER–DECEMBER 1959. *Reflets de "l'Economie mondiale" de W. Röpke:* H. LAUFENBURGER. *Etude comparée de l'imposition des personnes mariées:* O. OLDMAN and R. TEMPLE. *De la planification indicative:* J. VINCENS. *A propos de la réforme des finances locales françaises:* M. BAZOCHE. *Quelques aspects de la lutte contre l'inflation dans les pays de la Communauté Européenne:* J. AVENTUR.

VOL. LII, No. 1, JANUARY–MARCH 1960. *L'impossible "Réforme fiscale":* H. LAUFENBURGER. *Récente évolution de l'épargne et des investissements en Italie:* A. TITTA. *L'inégalité d'influence des devises: l'influence par l'emploi:* J. WOLFF. *Schacht, Financier:* M. RUDLOFF. *Réflexions sur "l'aspect XIX^e siècle" de la politique économique et financière de la V^e République:* P. BIACABE. *Report déficitaire: Amortissements différés ou du détournement de la compatibilité par le fisc:* L. RIVES.

Population

VOL. 14, No. 4, OCTOBER–DECEMBER 1959. *Les dimensions de la mortalité:* S. LEDERMANN and J. BREAS. *L'heure de la naissance:* M. F. GAUQUELIN. *Influence du rang de naissance sur la mortalité et les anomalies dans les familles consanguines:* J. SUTTER and S. LEDERMANN. *Étienne Hatvani et les origines de l'arithmétique politique en Hongrie:* R. HORVATH.

Consommation

No. 4, OCTOBER–DECEMBER 1959. *Un modèle prospectif du marché de l'automobile:* H. FAURE. *La consommation de fruits et de légumes. Le matériel ménager dans les foyers français (parc et achats):* J. ACQUIER.

Bulletin de l'Institut de Recherches Économiques et Sociales

VOL. XXV, No. 6, SEPTEMBER 1959. *Les transformations des coefficients de fabrication dans l'agriculture belge en rapport avec les prix et les coûts de production, 1936–58:* J. P. WAMPACH. *Les mouvements longs de l'industrie du plomb dans l'ouest européen:* A. E. SEPULCHRE. *Le progrès technique dans une miroiterie belge, 1930–58:* E. KNOOPS.

VOL. XXV, No. 7, NOVEMBER 1959. *La conjoncture économique de la Belgique:* L. H. DUPRIEZ.

Cahiers Economiques de Bruxelles

No. 5, OCTOBER 1959. *La comptabilité nationale de la Belgique, 1948–1958. Le capital fixe des entreprises:* H. JANNE and M. KIRSCHEN. *Le role du capital fixe des entreprises dans l'expansion économique: The role of capital in long-term projection models:* P. J. VERDOORN; *Measuring capital and the length of life of capital goods:* T. BARNA; *Les relations entre le capital, l'emploi et la production dans l'industrie de la République Fédérale Allemande:* R. KRENGEL.

Annales de Sciences Économiques Appliquées

VOL. 17, No. 5, DECEMBER 1959. *Aperçu de la conjoncture économique en Belgique. Biens de production brésiliens et Marché commun:* R. JAMEZ. *Diagnostic d'un système de "Merit Rating": Le contrôle des résultats de l'application d'un système de notation du personnel:* F. JUCKLER and J. T. LEHMANN. *Contrôle et essais des fers laminés:* E. ANTON.

Revue de l'Institut de Sociologie

No. 4, 1959. *Quelques remarques sur l'idée de la nature humaine:* M. OSSOWSKA. *La problèmes du développement économique de la Tunisie:* P. L. REYNAUD. *La naissance à Kenscoff, Haiti:* S. COMHAIRE-SYLVAIN. *Réformisme et conservatisme dans la politique sociale de Bismarck:* M. LIEBMANN. *L'interventionnisme libéral depuis J. M. Keynes:* P. FRANTZEN.

Jahrbücher für Nationalökonomie und Statistik

VOL. 171, No. 4, OCTOBER 1959. *Nochmals: Investition und Zins, Eine Revision:* E. PREISER. *Investieren, Sparen, Wirtschaftswachstum und Eigentumsbildung:* W. SCHREIBER. *Some Remarks on Dynamic Price Theory:* C. E. FERGUSON. *Qualitative und quantitative Aussagne über moderne Gruppenbildungen:* H. BOLZA and A. HOF.

Schmollers Jahrbuch

VOL. 79, No. 6, 1959. *Zur Soziologie der führenden Elite in unserer Zeit:* L. KOFLER. *Das Krisenproblem bei Marx und Keynes:* N. MOSZKOWSKA. *Unternehmungsforschung:* D. SCHIELE.

Die Weltwirtschaft

No. 2, 1959. *Weltwirtschaftlicher Überblick. Länderberichte. Marktberichte.*

Wirtschaft und Statistik

VOL. 11, No. 10, OCTOBER 1959. *Wohnungsausstattung und Wohnungsmiete:* A. SOBOTSCHINSKI. *Die Untermieterhaushalte:* M. EULER.

VOL. 11, No. 11, NOVEMBER 1959. *Zur Revision der Baupreisstatistik:* G. FÜRST. *Neuberechnung von Preismessziffern für Bauleistungen und eines Preisindex für Wohngebäude:* K. HORSTMANN. *Zahl und Struktur der Haushalte und Familien:* H. SCHUBNELL. *Die Bilanzen und Erfolgsrechnungen von Aktiengesellschaften in der Industrie für die Geschäftsjahre 1957 und 1958:* R. BERNDSEN. *Die Umsätze und ihre Besteuerung im Jahr 1958:* H. GOERKE.

VOL. 11, No. 12, DECEMBER 1959. *Zahl und Struktur der Haushalte von Einzelpersonen:* H. SCHUBNELL. *Preise im Beherbergungs- und Gaststättengewerbe:* I. HILLER. *Die Wohnverhältnisse der Arbeiter im Bergbau und in der Eisen- und Stahlindustrie:* M. EULER.

Zeitschrift für die Gesamte Staatswissenschaft

VOL. 115, No. 4, 1959. *Anmerkung zur Theorie der Einkommensteuersenkung:* R. RICHTER. *Die Z-Funktion und die 45° Linie: Zwei Formulierungen der Keynes'schen Theorie:* J. PEN. *Zur stochastischen Grundlegung der Ökonomie:* G. MENGES. *Die Konjunkturtheorie Joseph Schumpeters:* E. BERNHAUER. *Nichlineares Programmieren unter stochastischen Nebenbedingungen:* H. GÜLICHER. *Planwirtschaftliche Reformgedanken in Ungarn:* S. VARGA. *Rechtsform und Unternehmensverfassung:* H. KÖHLER.

Vierteljahrshefte zur Wirtschaftsforschung

No. 4, 1959. *Zur konjunkturellen Situation: Internationaler Überblick:* M. TESCHNER; *Westdeutschland:* H. MARTEL. *Volkswirtschaftliche Gesamtrechnung einschliesslich Geldvermögensrechnung für die Bundesrepublik: Drittes Quartal 1959:* K. D. ARNDT and H. SEILDER. *Betrachtungen zu dem Problem der europäischen Integration:* I. KÖHLER-RIECKENBERG. *Zur Verkehrs und Wirtschaftsentwicklung europäischer Eisenbahnen:* H. OTTO. *Der sowjetische Aussenhandel mit den Entwicklungsländern:* O. VON GAJZÁGÓ. *Entwicklung und Bedeutung der Tendenzbefragung in West-Berlin:* D. SCHOELER. *Blick in die Forschung:* K. HENKNER.

Allgemeines Statistisches Archiv

VOL. 43, No. 2, 1959. *Haushalt und Familie:* I. H. SCHUBNELL. *Econometrica Sovetica: I:* E. M. FELS. *Grundriss des Stichprobenverfahrens:* M. J. SLONIM. *Die Verwendung von LogAbax-Statistikund Buchungsmaschinen bei den Statistischen Landesämtern:* R. GIEHL.

Finanzarchiv

VOL. 20, No. 1, 1959. Probleme der Steuertheorie und der Steuerpolitik, Festgabe für Fritz Terhalle. *Der Problemkreis "Besteuerung und Wirtschaftspolitik" in der deutschen finanzwissenschaftlichen Literatur:* H. JECHT. *"Unmerkliche" Steuern:* G. SCHMÖLDERS. *Bemerkungen zur progressiven Besteuerung und zur steuerlichen Leistungsfähigkeit:* H. HALLER. *Ein vernachlässigtes Problem finanzpolitischer Sparförderung:* H. TIMM. *Zur Frage der Vermögensbildung in breiten Schichten:* L. WOLKERSDORF. *Unterschiede bei der Rücklagen- und Schuldenpolitik des Staates und der Gemeinden:* R. STUCKEN. *Unternehmenserhaltung und Gewinnbesteurung:* K. HAX. *Grundgesetz und Steuerreformen:* F. KLEIN. *Die Mitarbeit von Wirtschaftsorganisationen im Rahmen des deutschen Steuerwesens:* W. HÜBSCHMANN. *Zur Problematik der Besteuerung des Gewinns einerseits und der Ausschüttungen bzw. Entnahmen andererseits:* C. BOETTCHER. *Über einige Prinzipien des internationalen Steuerrechts:* O. BÜHLER. *Finanzpolitische Probleme des Gemeinsamen Marktes:* G. GAST.

Weltwirtschaftliches Archiv

VOL. 83, No. 1, 1959. *A Test on Two Hypotheses Concerning Interpretation of Input–Output Coefficients:* J. HALDI. *The Construction of Social Accounting Models:* MO-HUAN HSING. *Über Begriffe der Agrarwirtschaft:* G. KLAUDER. *Beitrag zum Problem der ökonometrischen Bestimmung einer Substitutionselastizität:* B. LEHBERT. *Bemerkungen zu einigen neueren Entwicklungen der Theorie der Unternehmung:* E. SCHNEIDER.

Wirtschaftsdienst (German Text, English Summaries)

VOL. 39, No. 10, OCTOBER 1959. *Price Developments on the European Markets. The Plastics Manufacturing Industry:* H. MORGENBESSER. *Insect Damage in Imported Goods and its Prevention:* H. WEIDNER.

VOL. 39, No. 11, NOVEMBER 1959. *Competition on the Common Market. Appropriate Size of Enterprises for the European Market:* L. BERGHÄNDLER. *Problems of Austria's Tourist Traffic:* W. STERMANN. *Future Aspects of Hamburg Port Traffic:* M. LENK.

VOL. 39, No. 12, DECEMBER 1959. *Competition on the Common Market. The Situation in the West German Iron and Steel Industry:* K. P. VIETZ. *Hamburg as Location of Oil-mills and Feed Industry:* A. VAN SETTEN.

Bayern in Zahlen

VOL. 13, No. 10, OCTOBER 1959. *Bayerns Bevölkerungsentwicklung im 1 Halbjahr 1959:* W. MAIER. *Statistik des Erholungsreiseverkehrs:* J. LEIPNER. *Die Schulden der bayerischen Gebietskörperschaften Ende März 1959:* J. WIRNSHOFER. *Die Erbschaftsteuerveranlagungen in Bayern im Kalenderjahr 1958:* R. SCHACHTNER. *Das Bauspargeschäft in Bayern 1958/59:* H. MAYR-ERLACHER. *Die öffentliche Fürsorge in Bayern in den Rechnungsjahren 1957 und 1958:* E. SCHMIDT. *Struktur der Arbeiterverdienste in Bayern:* A. HERR. *Die technischen und sanitären Einrichtungen der Wohnungen in Bayern:* F. ENGEL.

VOL. 13, No. 12, DECEMBER 1959. *Die Ausländer in Bayern:* W. MAIER. *Die Pflanzenbestände in den Baumschulen Bayerns:* F. ILLNER. *Die Bodennutzung in Bayern 1959:* J. EICHINGER. *Die Rauhfutterernte in Bayern 1959:* J. BUCK. *Die öffentlichen Ausgaben für die Schulen in Bayern:* J. WIRNSHOFER. *Umsätze und Umsatzsteuer in Bayern 1958:* J. SIEBER. *Jugendgerichts- und Bewährungshilfe der Jugendämter in Bayern:* E. SCHMIDT. *Die Arbeiter- und Angestelltenverdienste in Bayern im August 1959:* A. HERR. *Die Straffälligkeit der Erwachsenen in Bayern 1954 bis 1958:* W. ZANZINGER.

Zeitschrift für Nationalökonomie

VOL. XIX, No. 3, 1959. *Böhm-Bawerk und die Kapitalstruktur:* L. M. LACHMANN. *Some Problems of Income Determination and Welfare:* W. FROEHLICH. *Theorie und empirische Forschung in der Sozialwissenschaft:* B. FRITSCH. *Zur Frage der Wirtschaftsrechnung in der Zentralverwaltungswirtschaft:* A. NUSSBAUMER.

Monatsberichte des Österreichischen Institutes für Wirtschaftsforschung

VOL XXXII, No. 10, OCTOBER 1959. *Die wirtschaftliche Lage in Österreich. Saisonbewegung und Saisonbereinigung der Ausfuhr. Der Güter-Transitverkehr durch Österreich.*

VOL. XXXII, No. 11, NOVEMBER 1959. *Die wirtschaftliche Lage in Österreich.*

VOL. XXXII, No. 12, DECEMBER 1959. *Die österreichische Konjunktur an der Jahreswende 1959/60. Ergebnisse der Sondererhebung zur Konjunkturlage der Industrie Ende 1959. Österreichs Volkseinkommen im Jahre 1958. Die Verteilung des Volkseinkommens nach Bundesländern.*

Schweizerische Zeitschrift für Volkswirtschaft und Statistik

VOL. 95, No. 4, DECEMBER 1959. *Warum ist die schweizerische Volkswirtschaft, trotz der Kleinheit des Landes, so leistungsfähig?:* W. A. JÖHR and F. KNESCHAUREK. *Vier Diskussionsbeiträge zum Kartellgesetzentwurf: Missbrauchsbekämpfung auf Umwegen:* E. KÜNG; *Bemerkungen zum schweizerischen Kartellgesetzentwurf:* G. WINTERBERGER; *Der "Mögliche Wettbewerb" und die zivilrechtlichen Bestimmungen im Kartellgesetzesentwurf vom April 1959:* H. MERZ. *Die verwaltungsrechtlichen Bestimmungen des Kartellgesetzentwurfes:* H. NEF. *Die Anlagepolitik der AHV:* H. KUNG. *Zum Problem der Preisdifferenzierung:* A. E. OTT. *Labor in Organized Capitalism:* A. SCHWEITZER.

Aussenwirtschaft

VOL. 14, No. 4, DECEMBER 1959. *Betrachtungen zur Aussenwirtschaftspolitik:* H. BACHMANN and A. BOSSHARDT. *Die Wettbewerbsbestimmungen für Unternehmen in der Europäischen Wirtschaftsgemeinschaft und in einer europäischen Freihandelzsone:* T. FAIST. *Die fiskalischen Auswirkungen eines innereuropäischen Zollabbaus:* H. C. BINSWANGER. *Probleme der langfristigen Marktprognose:* F. KNESCHAUREK. *Aktuelle Zahlungs probleme im schweizerischen Maschinenexport nach dem Fernen Osten:* H. BACHMANN. *England als Exportmarkt der Schweiz:* A. NYDEGGER.

De Economist

No. 10, OCTOBER 1959. *De conjunctuurpolitiek in Westeuropees verband:* J. E. ANDRIESSEN. *Fragen der deutschen Währungspolitik:* K. BLESSING. *Enkele aspecten van het vraagstuk der rechtvaardige inkomensverdeling:* J. G. KNOL.

No. 11, NOVEMBER 1959. *Limperg tachtig jaar:* W. J. VAN DE WOESTIJNE. *Regionale welvaarstsverschillen en regionale politiek:* L. H. KLAASSEN. *Over het nemen van economisch verantwoorde beslissingen:* H. C. VAN STRAATEN.

No. 12, DECEMBER 1959. *Exposé succinct d'une théorie générale de la valaur:* M. GLANSDORFF. *Ons tarief der inkomstenbelasting zonder draagkrachtgedachte:* S. VISSER. *De theorie van het nationale inkomen en de toepassing daarvan, in verleden en heden:* P. E. VENEKAMP.

Nationalökonomisk Tidsskrift

VOL. 97, No. 3–4, 1959. *Nye linier i byggefinansieringen:* V. NØRBY. *Research in the Economics of the Agricultural Firm:* E. R. SWANSON. *Den tekniske udvikling og dansk industri:* A. N. NEERGAARD. *Om cross-section analyse af investeringsteorier:* I. GRÜNBAUM. *Lønstrukturen i dansk industri siden 1946:* A. H. DAHL.

Ekonomisk Tidskrift (Swedish text)

VOL. LXI, No. 4, DECEMBER 1959. *Erik Lindahl in memoriam. Contemporary Programs in Economic Theory:* E. SCHNEIDER. *Consistency of Traditional Consumption Theory with Socio-psychological Motives for Demand:* R. HELGESSON. *The Organization of Swedish Statistical System: A Proposal:* T. DALENIUS.

Skandinaviska Banken Quarterly Review

VOL. 40, No. 4, OCTOBER 1959. *Savings and Income Changes:* B. HANSEN and U. WALLBERG. *The Swedish Council for Personnel Administration:* R. LAHNHAGEN. *The Economic Situation in Perspective:* E. LUNDBERG.

Ekonomiska Samfundets Tidskrift

VOL. 12, NO. 4, 1959. *Fettförsörjningens problem:* J. STANDERTSKJÖLD. *Devalveringens problem:* H. BJÖRKQVIST. *Kring Prebisch-teorin:* K. TÖRNUDD. *Frie varebevaegelser og økonomisk politik:* E. OLSEN. *Investeringenes virkninger på importen:* T. THONSTAD. *Utrikeshandel och ekonomisk utveckling:* B. SÖDERSTEN. *Terms of trade och ekonomisk tillväxt:* E. LAATTO.

Giornale degli Economisti e Annali di Economia

VOL. XVIII, NO. 5–6, MAY–JUNE 1959. *Della ripartizione programmata degli investimenti in un'economia "mista":* F. FEROLDI. *Nuove annotazioni alla teoria marxista dei prezzi di produzione:* G. DEMARIA. *Introduzione alla teoria delle decisioni statistiche:* B. GIARDINA. *Sulla politica del risparmio:* G. FUÀ. *Lo Stato Pontificio e il movimento riformatore del Settecento:* G. PORISINI.

VOL. XVIII, NO. 7–8, JULY–AUGUST 1959. *Evoluzione moderna di una scienza antichissima:* G. DEMARIA. *Intorno alle distribuzoini binomiale ad esponente negative:* G. SANTACROCE. *Alcuni problemi di politica economica messi in evidenza dalla convertibilità monetaria:* L. ROSSI. *Carlo Ignazio Giulio economista e uomo politico:* A. GARINO CANINA. *Di alcuni caratteri e aspetti dell'economia dei trasporti:* M. TROISI. *Di una teoria generalizzata di correlazione bivariata:* M. ANDERSON. *Introduzione alla teoria delle decisioni statistiche: II:* B. GIARDINA.

Rivista di Politica Economica

VOL. XLIX, NO. X, OCTOBER 1959. *Osservazioni sulle economie astratte:* S. CHERUBINO. *Il diritto di stabilimento nella Comunità economica europa:* F. DE FONZO. *La C.E.E. e i diritti dei terzi paesi sotto l'aspetto doganale:* G. PATRIARCA.

VOL. XLIX, NO. XI, NOVEMBER 1959. *Depreciation:* JOAN ROBINSON. *Autofinanziamento e fluttuazioni cicliche:* P. REITANO. *La nuova Comunità francese: struttura politico-costituzionale ed aspetti economici:* G. RIOND. *Scambi oriente occidente e integrazione europea:* K. L. HERCZEG.

VOL. XLIX, NO. XII, DECEMBER 1959. *Definizione ed analisis di alcune tendenze del comportamento turistico:* F. BERTOLDI. *Stabilizzatori automatici dell'economia:* L. TAMBINI. *Produttività e trasporti:* M. TROISI. *E' configurabile oggi un nuovo ordine monetario internazionale?:* N. NARDUZZI.

Banca Nazionale del Lavoro Quarterly Review

NO. 50, SEPTEMBER 1959. *Agriculture, Economic Development and the Common Market: Italian Problems:* A. and A. PENNACCHIETTI. *The Italian Stock Market in the Post-war Period:* P. MANES. *Export Credits to Under-developed Countries on a Multilateral Basis.*

Rassegna Economica

VOL. XXIII, NO. 3, JULY–SEPTEMBER 1959. *Magazzini generali o Monti di pegni?:* N. GARRONE. *Politiche di stabilizzazione e congiuntura attuale:* J. WEILLER. *Prolegomeni ai piani regionali di sviluppo:* G. DI NARDI.

Review of the Economic Conditions in Italy (Banco di Roma)

VOL. XIII, NO. 6, NOVEMBER 1959. *Situation and Prospects of the Italian Fruit and Vegetable Sector in Relation to the Common Market:* F. TRADARDI. *Present Situation and Problems of the Italian Merchant Navy:* V. D. FLORE. *Progress and Prospects of the Italian Wool Textile Industry:* R. DODI.

Italian Affairs

VOL. VIII, NO. 5, SEPTEMBER–OCTOBER 1959. *The Economic Situation and National Income. Foreign Trade in 1958. State Assistance Organizations.*

Annali della Facoltà di Economia e Commercio, Università di Palermo

VOL. XIII, NO. 1, 1959. *Il metodo statistico nella rilevazione dei fenomeni sociali: recenti contributo a talune techniche di campionamento:* F. GALANTINO. *Tavole di fecondità generale per la popolazione siciliana 1950–53:* F. GALANTINO. *Produzione e commercio agrumario nella Regione Siciliana: attualità e prospettive:* F. MONASTRA. *La vischiosità dei prezzi nel settore dei generi alimentari:* G. MORELLO.

El Trimestre Economico

VOL. XXVI, NO. 104, OCTOBER–DECEMBER 1959. *Dos conferencias sobre el mercado común latinoamericano:* P. G. REYNOSA. *El papel de la tierra en el desarrollo económico:* T. W. SCHULTZ. *Tres ensayos sobre planeación económica:* O. LANGE. *Programación "lineal" of matemática: un enfoque no matemático:* R. DORFMAN.

Revista de Economia

VOL. XII, NO. 1–2, MARCH–JUNE 1959. *A Convertibilidade das Moedas e a Politica Económica Internacional:* A. RAMOS PEREIRA.

Boletin de Estudios Economicos

VOL. XV, NO. 38, SEPTEMBER–DECEMBER 1959. *La Comunidad Economica Europea:* T. WESSELS. *La integracion europea y la necesidad de una liberalizacion internacional:* W. KRAUS. *El Mercado Comun Europeo y la competencia:* H. K. SCHNEIDER. *Consecuencias financieras de la integracion economica:* J. L. URQUIJO DE LA POUENTE. *La economia alemana y el Mercado Comun: problemas internos de la empresa:* H. G. MEISSNER and S. G. ECHEVARRÍA. *La agricultura española y el Mercado Comun Europeo:* C. SÁIZ-ESTÍVARIZ. *La Zona de Libre Cambio: antecedentes historicos y situacion frente al Mercado Comun:* F. BARRENA. *Consejo Europeo de Coyuntura:* M. ARMACK. *El muestreo de trabajo como tecnica para determinar tiempos estandar:* J. H. ALEIXANDRE.

Revista de Desarrolio Económico

VOL. II, NO. 2, JANUARY–MARCH 1959. *Precios en la matriz de Leontief:* O. CORNBLIT. *El capital fijo renovable de la República Argentina en el periodo 1935–1955:* M. BALBOA and A. FRACCHIA. *Criterios de inversión y desarrollo económico:* J. M. DAGNINO PASTORE. *La programación presupuestaria:* G. MARTNER. *Limites económicos al incremento de población:* W. M. CORDEN. *Gastos públicos en la Provincia de Buenos Aires.*

Economic Bulletin of the National Bank of Egypt

VOL. XII, NO. 2, 1959. *Economic Conditions in 1958 in the United Arab Republic.*
VOL. XII, NO. 3, 1959. *Balance of Payments Estimates for 1959. U.A.R. Budget Estimates, 1959/60. Recent Changes in Banking Legislation Abroad.*

L'Egypte Contemporaine

VOL. 50, NO. 296, APRIL 1959. *Les Banques de Crédit Foncier dans la province égyptienne de la R.A.U.:* ABDEL MONEIM EL-TANAMLI.

The Annals of the Hitotsubashi Academy

VOL. X, NO. 1, AUGUST 1959. *New Facts and Figures on Japanese Public Finance:* H. ITO. *On the Method of the Economic Plan (1958–62) of Japan:* Y. YAMADA. *Balance of Trade and Economic Growth in Japan:* K. BABA. *Chronic Underemployment: A Comparison Between Japan and the United States:* A. H. GLEASON. *Increasing Populations and Industrial Structures:* T. MINOGUCHI. *On the Cost Factors in the Location Theory of Industry—Principle of Approach and Non-approach:* T. AOKI. *Bibliography of Economics Published in Japan in Western Languages, 1956–68.*

The Economic Review (Japanese text)

VOL. 10, NO. 3, JULY 1959. *An Analysis of "Differential Structure" of the Japanese Economy:* K. OHKAWA. *Inter-industrial Analysis of the New-long-range Economic Plan of Japan:* S. YOSHIUE. *Evaluation of Prediction Power:* T. UCHIDA and T. WATANABE. *Capital Formation and Saving:* K. EMI. *A Materialistic Conception of History and Society in John Millar:* S. OHNO. *Inter-industry Correlation between the Organic Composition of Capital and the Rate of Profit (in English):* J. M. GILLMANN.

Voprosy Ekonomiki (Russian text; an English translation is also published)

NO. 9, 1959. *New Depreciation Charges for Fixed Assets:* A. EFIMOV. *On the Characteristics of Socialist Reproduction at the Present Stage:* YA. KRONROD. *Problems of the Specialisation and*

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No. 10, 1959. *The Electrification of the Country and the Location of Production in the Period of Intensive Construction of Communism:* M. VILENSKY. *The Important Economic Problem of Technical Progress:* K. ZVAGINTSEVA. *Some Factors in the Progress of Collective-farm Economy:* L. FLORENTEV. *Lowering Production Outlays in Collective Farms:* I. RYBALCHENKO. *The Growth of Labour Productivity in State Farms:* K. KONDRATEV. *Specialisation—The Most Important Condition for the Development of Suburban Agriculture:* E. RUDAKOVA. *Some Theoretical and Practical Problems of Credit in the U.S.S.R.:* V. BATYREV. *Prospects for House-Building and the Census of Dwellings in the U.S.S.R.:* K. VINOGRADOV. *Supply and Demand under Socialism:* S. PARTIGUL. *Questions of the Definition of Economic Regions and the Location of Industry in Socialist Countries:* E. ALAEV. *Forms of Economic Co-operation Among Socialist Countries:* I. IVANOV. *Non-ferrous Metallurgy and Technical Progress:* B. CHUGUNOV. *The Development of Co-operative Links Between Collective Farms:* S. SEMIN. *Fully Utilise Reserves of Livestock Raw Materials for Industry:* M. LYASHKO. *The Polish Industrial Exhibition in Moscow:* A. CHERNOV. *A Scientific-production Conference on Questions of Production Organisation and the Utilisation of Reserves:* G. DEVYATOV and E. ISAEV. *Changes in Economics Curricula:* G. KHUDOKORMOV. *In the Production Economics Section of the Economic Council of the Moscow City Sovnarkhoz:* S. FORMICHEV. *Economic Accounting with the Aid of Electronic Computers:* V. BELKIN.

Planovoe Khozyaistvo (Russian text)

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No. 10, 1959. *Improve Planning in Sovnarkhozy. Ways to Raise Labour Productivity in Agriculture:* K. EREMEEV. *Raise Lagging Collective Farms to the Level of the Advanced Farms:* I. TSIKOTO. *The Expansion of Meat Production—One of the Most Important Tasks of the Seven-year Plan:* E. VALYUZHENICH. *Questions of Long-term Planning in Collective Farms:* KH. GIMADEEV. *The Elaboration of New Depreciation Charges:* K. PETROSYAN. *Railway Electrification in the Seven-year Plan:* A. KUCHKO. *The Technical and Economic Efficiency of Opencast Coal-mining:* B. BRATCHENKO. *The Chinese Nation is Advancing Rapidly on the Road of Socialist Construction:* LI FU-CHUN. *The German Democratic Republic on the Road of Socialist Construction:* B. LEUSCHNER. *The Potential of the Kemerovo Economic Region for Pre-schedule Fulfilment of the Seven-year Plan:* A. FASTOVSKY. *Timber Resources in the Far East and Scope for their Rational Exploitation:* A. TSYMEK. *Scope for Lowering Building and Installation Costs in the Chelyabinsk Economic Region:* M. TARASENKO.

Finansy S.S.S.R. (*Russian text*)

No. 8, 1959. *The Decisions of the June Plenum of the Party Central Committee—at the Basis of the Work of Finance Agencies. Establish the 1960 State Budget of the U.S.S.R. Efficiently and Expeditiously:* G. DUDINKOV. *In the Struggle to Fulfil the Decisions of the XXI Party Congress:* F. KOKHONOV. *Major Problems of the Efficiency of Capital Investment:* A. FERBERG. *Mines Must Be Profitable:* K. MILHAILOV. *Improve the Activity of R.T.S., Lower Outlays in Their Upkeep:* M. BEILINSON. *Costly Statuary:* S. KUSTOV. *On Calculating Money Income for Allocations to the Indivisible Funds of Collective Farms:* G. STRAUSMANIS. *The Setting of Standard for Working Capital in Automobile Transport:* L. TESLER and R. FAINSHTEIN. *The Revaluation of Fixed Assets and Finance Agencies:* P. BUNICH. *Price Problems in Bulgaria:* A. ALEKSEEV. *American "Aid" and Turkish Finances:* R. FARAMAZYAN. *A Meeting on the Establishment of the Draft State Budget for 1960. On Improving Financial Work in Industry:* E. UTKIN. *A Seminar on Trade Finance in the Ukraine:* M. KABANETS.

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Dengi i Kredit (*Russian text*)

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Vestnik Statistiki (*Russian text*)

No. 8, 1959. *On Some Statistical Indicators of New Techniques in Industry:* M. LESHCHINSKY, V. SURINA and M. TKACHEVA. *The Use of Grouping for the Economic Analysis of Collective Farms:* V. MACHENKOV. *The Computation of Industrial Production Index Numbers in Hungary:* O. LUKACS. *The Training of Computers in the Educational System of the Central Statistical Administration of the U.S.S.R.:* P. VLASOV and S. SELEZNEV. *On the Problem of Measuring*

Labour Input in Constructing Indicators of Labour Productivity: E. ANTOSENKOV. *On Computing Regional Index Numbers:* Z. SIDILIK. *Defining the Replacement Value of Metal-cutting Machine Tools and Forging-pressing Equipment:* A. STEPANOV. *How to Measure the Wear and Tear of Fixed Assets in Connection with Their Revaluation:* V. GOBELIK. *A Meeting on Problems of Measuring the National Income of Union Republics:* M. R. *A Meeting of Heads of Statistical Offices of Autonomous Republics, Krais and Oblasts of the Russian Federation:* V. UVAROV.

No. 9, 1959. *The Revaluation of Fixed Capital Has Begun. The Economic Efficiency of Capital Investment and Its Statistical Analysis:* N. SHCHADILOV. *On the Comparability of Dynamic Series:* YA. KABACHNIK. *How to Establish the Replacement Value of Equipment in Thermal-Electric Stations:* A. STEPANOV. *The Practical Application of the Handbooks on Aggregate Indicators of the Value of Dwellings and Communal Buildings:* V. PETROPAVLOVSKY. *A Meeting Convened by the Editorial Board of* Vestnik Statistiki *on the Application of Mathematics to Economic Research and on Econometrics.*

No. 10, 1959. *On the Eve of the Plenum of the Party Central Committee. Statistical Work at the Present Stage of Socialist Construction in the Chinese People's Republic:* TSZYA TI-YUN. *Successes of the Chinese People's Republic in Economic Development:* M. SLADKOVSKY. *Economic Characteristics of the Population in the Processing Programme of the 1959 Census:* V. ROZDYALOVSKAYA. *On Statistics of Foreign Trade in the U.S.S.R.:* V. ZOLOEV. *On the Question of the Divergence of Prices from Cost in Elaborating National Accounts:* A. SMIRNOV. *On the Problem of Defining the Degree of Obsolescence under Socialism:* A. BUZAN. *How to Check Collective-farm Accounts for Motor Transport:* S. BELOV. *The VII Plenary Session of the Conference of European Statisticians:* V. OVSIENKO. *Problems of the Comparability of Statistical Data on an All-European Basis:* A. PETROV.

Ekonomista (Polish text, English and Russian summaries)

No. 2, 1959. *On the Socialist Way of Production:* S. STRUMILIN. *On the Question of the Concept of Commodity Relations:* J. MUJZEL. *Some Remarks on Input–Output Tables:* E. VIELROSE. *On the Growth of Production of Producers' and Consumers' Goods:* B. MINC. *The Rate of Investment as Expressed in the Structure of Employment:* J. PAJESTKA. *Contemporary Bourgeois Theories of Economic Growth:* H. FLAKIERSKI. *Problems of Economic Growth in Under-developed Countries, with Special Reference to Western Asia:* I. SACHS. *Remarks on the Theory of the "Big Push":* P. ROSENSTEIN-RODAN. *State Intervention in the Sphere of Credit and the Functions of the Central Bank in the Principal Capitalist Countries:* J. RUTKOWSKI. *Critical Remarks on the macro-economic Method of Analysis and the Concept of Equilibrium:* W. FABIERKIEWICZ. *White-collar Workers in the United States:* Z. DOBRSKA.

No. 3, 1959. *A Model of Economic Growth:* O. LANGE. *Tables of Inter-industry Flows in the Polish Economy:* E. KRZECKOWSKA, B. SZYBISZ and L. ZIENKOWSKI. *Some Problems of the Application of Mathematics in Economic Research:* J. PAJESTKA. *The Influence of Migration from Agriculture on the Growth of National Income:* W. HERER. *The Cost and Income Function of the Remuneration of Labour in Small Peasant Farms:* H. CHOLAJ. *The Role of Capital Exports from Industrialised Countries in the Economic Development of Backward Countries:* Z. DOBRSKA. *The Problem of Planning Economic Development in France:* J. GRZYWICKA.

Politická Ekonomie (Czech text, some English and Russian summaries)

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Finansi i Kredit (Bulgarian text)

No. 6, 1959. *The Tasks of This Journal in Connection with the Aim of Economic Advance in Our Country. For Improved Operation of the Bulgarian National Bank:* B. Bulgaranov. *On Planning and Distributing Profits:* V. Todorov. *The Bulgarian State Lottery:* I. Paliiski. *For the Financial Strengthening of Merged Co-operative Farms:* G. Sotirof. *Credits for Insurance:* B. Vasilev. *For Strengthening the Operations of the Bulgarian National Bank Over Industrial Enterprises to Liquidate Their Over-plan and Excess Stocks:* D. Khristov. *New Regulations for Settlement on Acceptance Forms:* P. Khavezov. *The Economic and Financial Situation in Turkey:* A. Stoichev.

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Ekonomski Pregled (Serbo-Croat text, some English summaries)

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Ekonomist (Serbo-Croat text, some English summaries)

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Statisztikai Szemle (Hungarian text, English and Russian summaries)

August–September 1959. *The Preparation of the 1960 Hungarian Census of Population, Its Data Collection and Processing Programme:* A. Klinger and E. Szabady. *Analysis of Building Time:* I. Gerő and F. Kocsis. *A Study Tour in the Central Statistical Office of the Soviet Union:* F. Deák and O. Lukács. *Some Factors of the Commercial Attraction Effect:* G. Lacza. *Statistical Accounting of Production Costs in Socialist Farms in the German Democratic Republic:* U. Lange. *Problems of the Transport and Communication Sector in the 1957 Input–Output Table:* B. Lendvai and I. Szabó. *The Seventh Plenary Session of the Conference of European Statisticians:* Z. Kenessey. *The Application of Electronic Computers to Statistical Work:* L. Pintér. *Secondary Agricultural Education:* T. Pásztory. *The Analysis of Changes in the Balance of Trade:* A. Marton.

Probleme Economice (Rumanian text: English, French and Russian summaries)

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Ekonomia Popullore (Albanian text)

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NEW BOOKS

British

ADRIAN (LORD). **The Risks of Progress.** The Sixth Fawley Foundation Lecture. Southampton: University of Southampton, 1959. 8½″. Pp. 17. 2*s.* 6*d.*

[The question considered by Lord Adrian in this lecture is what our attitude should be towards the possible harmful consequences, especially genetical consequences, of scientific and medical advances which in themselves are immediately beneficial. Radiation hazards are the plainest case in point. Lord Adrian suggests that it will take so many generations for any substantial genetical changes to take place that one may reasonably hope that in the meanwhile medical science will have advanced sufficiently to enable us to cure or avoid the possible ill-effects.]

ALLEN (G. R.). **Agricultural Marketing Policies.** Oxford: Blackwell, 1959. 9″. Pp. xii + 336. 42*s.*

[To be reviewed.]

ALLEN (R. G. D.). Mathematical Economics. Second edition. London: Macmillan, 1959. 9″. Pp. xviii + 812. 63*s*.

[In this second edition Professor Allen has not altered the general lay-out or contents of his book. He has made numerous corrections and revisions on points of detail, and he has also completely re-written a number of sections. A long new appendix is added on certain concepts of modern algebra. These improvements serve to establish the book yet more firmly as easily the best available in this field.]

BEER (S.). Cybernetics and Management. London: English Universities Press, 1959. 9″. Pp. xviii + 214. 25*s*.

[To be reviewed.]

Budgeting in Public Authorities, by a Study Group of the Royal Institute of Public Administration, under the Chairmanship of R. S. EDWARDS; Research Officer, J. S. HINES. London: Allen & Unwin, 1959. 9″. Pp. 300. 28*s*.

[To be reviewed.]

CARTER (C. F.) and WILLIAMS (B. R.). Science in Industry. Policy for progress. London: Oxford University Press, 1959. 9″. Pp. x + 186. 21*s*.

[To be reviewed.]

CRANKSHAW (E.). Khrushchev's Russia. Harmondsworth, Middlesex: Penguin Books, 1959. 7″. Pp. 175. 2*s*. 6*d*.

[Mr. Crankshaw's latest book on Russia is an interesting and informative popular discussion of the expected themes. He deals with the political, economic and social problems that the Soviet leaders have faced since Stalin's death. The treatment of economic issues is largely in non-quantitative terms, but it contains much vivid and useful information derived from the author's many visits to Russia and his diligent reading of the Soviet Press. Particularly interesting are the examples he quotes of the distortion introduced into the working of the Soviet economy by suppressed inflation before 1957. Mr. Crankshaw's views and speculations on the psychological and sociological consequences of recent political and economic developments are also interesting and often convincing.]

DAY (A. C. L.). The Economics of Money. Home University Library, No. 242. London: Oxford University Press, 1959. 6½″. Pp. viii + 248. 7*s*. 6*d*.

[To be reviewed.]

DENMAN (D. R.) and STEWART (V. F.). Farm Rents. A comparison of current and past farm rents in England and Wales. London: Allen & Unwin, 1959. 9″. Pp. 206. 27*s*. 6*d*.

[To be reviewed.]

GOLDSMITH (R.) and SAUNDERS (C. T.) (Eds.). The Measurement of National Wealth. Income and Wealth, Series VIII. London: Bowes & Bowes, 1959. 8½″. Pp. xiv + 389. 45*s*.

[To be reviewed.]

GORST (SHEILA). Co-operative Organization in Tropical Countries. A study of co-operative development in non-self-governing territories under United Kingdom administration, 1945–1955. Oxford: Blackwell, 1959. 7½″. Pp. xv + 343. 25*s*.

[This contains a factual survey of the development of co-operation in twenty-eight non-self-governing British dependencies since the War, followed by a general analysis of the picture revealed by the detailed description. The chief spheres of co-operative organisation in the countries concerned are in agricultural credit and, where marketing boards have adopted a favourable attitude, in agricultural marketing. Mrs. Gorst writes as an enthusiast for the co-operative principle, but she takes a realistic view of its weaknesses and limitations in practice, and she has many useful suggestions to make on the most promising fields and forms for its further development.]

HALFORD (R. C.). Differential Costs and Management Decisions. London: Pitman, 1959. 9″. Pp. x + 115. 15*s*.

[To be reviewed.]

HORSEFIELD (J. K.). British Monetary Experiments, 1650–1710. London: Bell for the London School of Economics, 1960. 9″. Pp. xx + 344. 45*s*.

[To be reviewed.]

HUGHES (T. J.) and LUARD (D. E. T.). The Economic Development of Communist China, 1949–1958. London: Oxford University Press for the Royal Institute of International Affairs, 1959. 9″. Pp. viii + 223. 22*s.* 6*d.*

[To be reviewed.]

International Economic Papers, No. 9. Translations prepared for the International Economic Association. London: Macmillan; New York: The Macmillan Company, 1959. 10″. Pp. 248. 21*s.*

[To be reviewed.]

JACOBSSON (P.). Towards a Modern Monetary Standard. The Stamp Memorial Lecture 1959. London: The Athlone Press, University of London (distributed by Constable & Co., 12 Orange Street, W.C.2), 1959. 8½″. Pp. 31. 3*s.* 6*d.*

[In this lecture Dr. Jacobsson expresses the liberal point of view with which his name is now associated. He surveys three main fields of policy: the maintenance of exchange stability, the mitigation of booms and depressions, and the relation between monetary expansion and economic growth. In the field of international monetary policy he looks forward to a not too distant day when the major trading nations will feel able to do away with all exchange controls, including control of capital movements. For purposes of domestic stabilisation, he believes that paramount importance attaches to monetary policy, and also that adjustment of costs and prices in recessions has a greater contribution to make than is commonly believed. Finally, in considering the long-run problems involved in deciding on the rate of growth of the monetary supply, he emphasises the need for independence on the part of the central bank. Dr. Jacobsson puts his point of view persuasively and with more moderation than can be conveyed in a brief summary.]

KEIRSTEAD (B. S.). Capital, Interest and Profits. Oxford: Blackwell, 1959. 9″. Pp. x + 180. 22*s.* 6*d.*

[To be reviewed.]

LIPSET (S. M.) and BENDIX (R.). Social Mobility in Industrial Society. London: Heinemann, 1959. 9″. Pp. xxii + 309. 30*s.*

[This book is a survey and interpretation of the research that has hitherto been done on the problem of social mobility, together with a report on the findings of a particular case-study (the Oakland study). It is based on a number of articles that have already been published by the authors and their collaborators, but these articles have now been woven into a whole and have also been greatly extended, largely by fuller treatment of the findings of other investigators. The result is an impressive piece of work, which brings together an enormous amount of material and will undoubtedly become a standard reference on the subject. The most important broad conclusion is that the degree of social mobility differs comparatively little between the countries for which survey data exist and has not changed much over time. In their conclusions the authors suggest that the value judgments of many writers on social mobility are based on over-simplified and outdated factual assumptions.]

MACMILLAN (W. M.). The Road to Self-rule. A study in colonial evolution. London: Faber & Faber, 1959. 9″. Pp. 296. 35*s.*

[To be reviewed.]

National Insurance Act, 1959. Interrelation with occupational pension schemes. A financial analysis. London: The Life Offices' Association (33 King Street, Cheapside, E.C.2); Edinburgh: Associated Life Offices (23 St. Andrew Square, Edinburgh 2), 1959. 9½″. Pp. 23.

[This booklet has been prepared to assist employers and others to see how they stand in the light of the National Insurance Act, 1959. It shows the cost of providing the graduated pensions included in the Act and discusses the alternative lines of action open to employers regarding occupational pension schemes.]

PENROSE (EDITH T.). The Theory of the Growth of the Firm. Oxford: Blackwell, 1959. 9″. Pp. viii + 272. 35*s.*

[To be reviewed.]

POLLARD (S.). A History of Labour in Sheffield. Liverpool: Liverpool University Press, 1959. 9½″. Pp. xx + 372. 35*s.*

[To be reviewed.]

Readings in the Economics of Taxation, Selected by a Committee of the American Economic Association. London: Allen & Unwin, 1959. 9″. Pp. x + 581. 36*s.*

[This is a most interesting addition to a now famous series. The coverage is deliberately restricted to one section of the field of public finance, partly because the series already contains

Readings in Fiscal Policy. The collection starts with a group of six papers on broad questions of equity and utility in taxation theory. This is followed by four papers on welfare implications. The remaining twenty-two items deal with incidence and incentive effects in their various applications, including the theory of income taxes, sales taxes and taxes on property. The collection differs from many recent volumes of readings in the amount of space given to older writers. Fourteen of the thirty-two articles date from before 1930, and only eight of them are later than 1945. The authors have cast their net widely, and the criticism levelled at some of the earlier volumes in the series regarding over-representation of American economists cannot be made in this case.]

STRACHEY (J.). The End of Empire. London: Gollancz, 1959. 9″. Pp. 351. 30*s*.

[To be reviewed.]

SUPPLE (B. E.). Commercial Crisis and Change in England, 1600–1642. A study in the instability of a mercantile economy. Cambridge Studies in Economic History. London: Cambridge University Press, 1959. 8½″. Pp. xii + 296. 42*s*.

[To be reviewed.]

Tariffs and Trade in Western Europe. A report by PEP. London: Political and Economic Planning, and Allen & Unwin, 1959. 10″. Pp. 119. 30*s*.

[This is a work of reference. Detailed particulars are given of the tariffs imposed on over a thousand different commodities, classified as far as possible according to the Brussels Nomenclature, by each of the countries comprising the E.E.C. and the E.F.T.A. On the page opposite the tariff schedules are given the value of United Kingdom imports of the commodities concerned from E.E.C., the rest of O.E.E.C., the Commonwealth and the rest of the world.]

VERNEY (D. V.). Public Enterprise in Sweden. Liverpool: Liverpool University Press, 1959. 9″. Pp. x + 132. 21*s*.

[To be reviewed.]

WIBBERLEY (G. P.). Agriculture and Urban Growth. A study of the competition for rural land. London: Michael Joseph, 1960. 8½″. Pp. 240. 21*s*.

[To be reviewed.]

York: A Survey, 1959. York: Local Executive Committee on the occasion of the meeting of the British Association in York, 1959. 9″. Pp. 198.

[This contains a series of some twenty mainly factual essays by different authors on the geography of the region in which York is situated, on the history of the city, and on its economic and social structure. The book is published on the occasion of the 1959 meeting of the British Association in York.]

American

Administered Prices and Inflation. Some public policy issues. Washington, D.C.: Chamber of Commerce of the United States, 1959. 8½″. Pp. 81. $1.00.

[This pamphlet sets out to contest the view that inflation is caused or aggravated by the administered price practices of large-scale concentrated industries. It therefore argues against the policy conclusion which would follow from this view, namely that the right way to control inflation is by imposing price controls.]

The Allocation of Economic Resources. Essays in honor of Bernard Francis Haley. Stanford, California: Stanford University Press (London: Oxford University Press), 1959. 9½″. Pp. 244. 40*s*.

[To be reviewed.]

BATCHELOR (J. H.). Operations Research. An annotated bibliography, second edition. Saint Louis, Missouri: Saint Louis University Press, 1959. 9″. Pp. 866.

[This formidable bibliography lists over 4,000 items on operations research arranged by alphabetical order of authors. Each of the items mentioned is given a brief descriptive summary, usually of 50–100 words. An index is included which facilitates reference to particular branches of the subject.]

BLOOMFIELD (A. I.). Monetary Policy under the International Gold Standard: 1880–1914. New York: Federal Reserve Bank of New York, 1959. 9″. Pp. 62. 50c.

[To be reviewed.]

BRY (G.). The Average Workweek as an Economic Indicator. National Bureau of Economic Research, Occasional Paper 69. New York: National Bureau of Economic Research (261 Madison Avenue, New York 26), 1959. 9″. Pp. 116. $2.00.

[The length of the average working week is found to vary with the level of business activity, and it leads in time by a significant margin at turning-points. It may therefore be used as an instrument of prediction, and this is the aspect which the author is chiefly interested in. He presents the relevant data for the economy as a whole and for sectoral subdivisions, and he compares the cyclical behaviour of the workweek with that of related magnitudes, such as total manhours worked, total employment, etc. He also discusses the features of the labour market and of managerial labour policy that cause changes in the length of the workweek to precede changes in the general level of activity and production in the manner referred to.]

CHENERY (H. B.) and CLARK (P. G.). Interindustry Economics. New York: Wiley (London: Chapman & Hall), 1959. 9¼″. Pp. xv + 345. 64*s*.

[To be reviewed.]

The Comparative Study of Economic Growth and Structure. Suggestions on research objectives and organization. New York: National Bureau of Economic Research 1959. 9″. Pp. viii + 200. $3.00.

[The first half of this document consists of a most useful survey by R. W. Goldsmith of the present state and future prospects of research on comparative growth and structure. The author discusses both the substantial issues on which research is being carried out and also questions of method. The second part contains eleven short essays by leading economists on various aspects of research in this field.]

DIEBOLD (W.). The Schuman Plan. A study in economic co-operation, 1950–59. New York: Praeger for the Council on Foreign Relations (London: Oxford University Press), 1959. 9″. Pp. xviii + 750. 57*s*. 6*d*.

[To be reviewed.]

FELS (R.). American Business Cycles, 1865–1897. Chapel Hill, North Carolina: University of North Carolina Press (London: Oxford University Press), 1959. 9″. Pp. viii + 244. 48*s*.

[To be reviewed.]

FRIEDMAN (M.). The Demand for Money: Some Theoretical and Empirical Results. National Bureau of Economic Research, Occasional Paper 68. New York: National Bureau of Economic Research, 1959. 9″. Pp. 25. 75c.

[This is a preview of part of a larger study being conducted at the National Bureau by Professor Friedman and Mrs. A. J. Schwartz. Its main feature is the application of Professor Friedman's notion of " permanent " income as the magnitude to which the demand for money may be adjusted. The paper originally appeared as an article in the *Journal of Political Economy*, August 1959.]

GAULT (E. H.). Departmental Merchandising Results in Small Department Stores 1956–58. Michigan Business Reports No. 30. Ann Arbor, Michigan: Bureau of Business Research, University of Michigan, 1959. 9″. Pp. 103. $4.00.

[The stores whose results are analysed in this paper belong to a class which has been undergoing a relative decline, partly on account of shifts of population and partly on account of the development of new types of retail outlet. The difficulties experienced by small department stores are duly shown up in the figures, particularly those relating to the year 1958, when the long-term difficulties were aggravated by the recession.]

HANNA (F. A.). State Income Differentials 1919–1954. Durham, North Carolina: Duke University Press (London: Cambridge University Press), 1959. 9¼″. Pp. xx + 268. 56*s*. 6*d*.

[The author analyses differences in income per head between the forty-eight states of the Union in respect of their extent, their movement over time and the relative magnitudes of the causes bringing them about. In percentage terms, differences have narrowed over time, but the ranking of states has altered comparatively little. A large part of the analysis is concerned with the contribution to inter-state income differentials made by differences in occupational and industrial structure.]

HARMON (E. M.). Commodity Reserve Currency. The Graham-Goudriaan proposal for stabilizing incomes of primary commodity producers. New York: Columbia University Press (London: Oxford University Press), 1959. 9¼″. Pp. 140. 28*s*.

[To be reviewed.]

Investment for Jobs. Washington, D.C.: Chamber of Commerce of the United States, 1959. 8¼". Pp. 24. 50c.

[This is a study of the amount of investment likely to be needed in the next few decades in the United States in order to provide jobs for the foreseeable increase in the labour force. The working assumption used is that it costs some $15,000 of investment to create each new job in industry. A considerable part of the pamphlet is devoted to rather general arguments about the environment favourable to business expansion.]

JAFFE (A. J.). People, Jobs and Economic Development. A case history of Puerto Rico supplemented by recent Mexican experiences. A report of the Bureau of Applied Social Research of Columbia University. Glencoe, Illinois: The Free Press, 1959. 8¼". Pp. xix + 381. $6.00.

[The author uses material he has collected relating to Puerto Rico in order to establish the following conclusions. When medical science lowers the death-rate in an under-developed country it may take a generation or more for changes in attitudes and habits to come about which will lead to a corresponding fall in the birth-rate, and in the meanwhile population will increase by a factor of two or more. At the same time the amount of underemployment is so great that very considerable economic expansion can take place without calling for any extra labour, and therefore the increase in the supply of labour brought about by population growth will not necessarily be absorbed even if there is a large rise in G.N.P. As a result, discontent and a sense of frustration may persist or even become worse, notwithstanding a rise in average income per head. In order to avoid this, the Government must strenuously seek to spread the benefits of rising output by welfare and educational schemes, which in addition to lessening discontent directly will also have the still more important advantage of hastening the adoption of attitudes favourable to family limitation. These conclusions are of a generally familiar kind, but the detailed evidence relating to Puerto Rico with which the author supports them is of interest.]

KEEZER (D. M.) and others. New Forces in American Business. An analysis of the economic outlook for the '60s. New York and London: McGraw-Hill, 1959. 8". Pp. xiii + 279. $4.75.

[This is a vigorous, informative, but not very profound survey of the prospects of the American economy. The authors take up in turn the familiar topics: the prospects for maintaining high levels of investment and consumption; the role of government; competition; inflation; agriculture; and international economic relationships. On all these topics much interesting and relevant material is lucidly presented, and the authors then proceed to draw forthright and, on the whole, optimistic conclusions. On the basic question about the prospects for investment, a number of factors are named which in the authors' view should prevent any exhaustion of investment opportunities. These are interesting, but do not seem to add up to an entirely convincing proof that the character of the economy has, as the authors claim, undergone a major change compared with pre-war. They include: the increased importance of research; the scope for replacement of obsolescent equipment; the growth of amenity investment, which does not add to productive capacity; the increased flow of depreciation allowances; and, rather surprisingly, the prospective shortage of labour, which many theoretical economists would treat as a factor *limiting* investment opportunities.]

MADDEN (C. H.). The Money Side of "The Street." New York: Federal Reserve Bank of New York, 1959. 9". Pp. 104. 70c.

[This is an informative popular account of the New York money market and its mechanics, particularly as they are related to Federal Reserve operations.]

MALENBAUM (W.). East and West in India's Development. The economics of competitive coexistence. Washington, D.C.: National Planning Association (London: Oxford University Press), 1959. 9". Pp. x + 67. 14*s*.

[The author analyses current plans and future prospects for economic development in India, with special reference to the part played by aid from Western countries and from the Soviet bloc. From the political standpoint he finds cause for concern in the fact that Soviet aid is concentrated in a relatively small number of easily identified projects, whereas Western aid, though much larger in total amount, is widely diffused and is therefore superficially less impressive. More seriously disturbing, however, is the unsatisfactory outcome that now seems probable of the Second Five-year Plan period. This, in Dr. Malenbaum's view, is due less to lack of resources, such as increased Western aid might supply, than to shortcomings in the conceptual basis of the Plan. He suggests that the most helpful course might be if closer co-operation between the West and India could be achieved in working out the future programme for Indian economic development as a whole.]

MUSOLF (L. D.). Public Ownership and Accountability. The Canadian experience. Cambridge, Mass.: Harvard University Press, 1959. 8¼". Pp. xii + 174. 32*s*.

[This is a readable essay in a field where this quality is too often lacking. It discusses in the light of Canadian experience the difficulties involved in striking the right balance in the working of

public corporations between independence and detailed accountability to government or parliament.]

Prerequisites for Economic Growth. National Industrial Conference Board Studies in Business Economics No. 66. New York: National Industrial Conference Board (460 Park Avenue, New York 22), 1959. 9". Pp. 80.

[This is a verbatim transcript of a discussion on some of the leading issues concerning growth between a group of economists brought together by the National Industrial Conference Board. Each of the participants was given the opportunity to make one major contribution, and these longer statements are linked together by some lively discussion. Quite a number of interesting points are raised, not all of them very familiar—such as the statement that the United States and Canada are nowadays the only countries in the world that experience actual falls in income in cyclical recessions. The chairman at the discussion was Solomon Fabricant.]

STOVEL (J. A.). Canada in the World Economy. Cambridge, Mass.: Harvard University Press (London: Oxford University Press), 1959. 8½". Pp. xiii + 364. 60*s*.

[To be reviewed.]

WARREN (H. G.). Herbert Hoover and the Great Depression. New York and London: Oxford University Press, 1959. 8½". Pp. 372. 50*s*.

[This is primarily a study in politics and administration rather than in economic history. Hoover's early career is described, and the author then proceeds to consider the efforts made by his administration to stem the depression. The various measures undertaken and the personalities involved are described in much detail.]

Swedish

ARTLE (R.). Studies in the Structure of the Stockholm Economy. Towards a framework for projecting metropolitan community development. Stockholm: The Business Research Institute at the Stockholm School of Economics, 1959. 9½". Pp. 197.

[To be reviewed.]

LINDBECK (A.). The "New" Theory of Credit Control in the United States. Stockholm: Almqvist & Wiksell for the Institute for Social Sciences of the University of Stockholm, 1959. 9½". Pp. 56. Sw.kr. 4.

[This is a critical survey of the "availability" doctrine of credit control, associated especially with the name of Robert Roosa, according to which small changes in prices of government securities may have important effects on real expenditure, even if the interest-elasticity of investment and consumption are low. The author reviews the various strands in the doctrine and examines their validity and mutual consistency.]

NURKSE (R.). Patterns of Trade and Development. Wicksell Lectures 1959. Stockholm: Almqvist & Wiksell, 1959. 9½". Pp. 63. Sw.kr. 3.50.

[These characteristically lucid and stimulating lectures were delivered by Professor Nurkse shortly before his death. They exemplify the combination of economic history and theory at which he excelled. The first lecture contrasts the impact of world economic development on international trade in the nineteenth and twentieth centuries. In the nineteenth century the economic growth of the North Atlantic economy was transmitted to other regions through an enormous expansion of demand for primary products. In the twentieth century, for a variety of reasons, this pattern of "growth through trade" has been and is likely to be a good deal less prominent. In his second lecture Professor Nurkse considers in the light of this the uses to which developing countries should devote the steadily accruing increments to their productive resources—the dynamic aspect of the theory of comparative advantage. The three alternatives are: increased output of primary products for export; increased output of manufactures for export to advanced countries; and expansion of output for domestic markets and for trade with other backward countries. Professor Nurkse reviews the obstacles to the first two of these and concludes that the third is bound to play a larger part than it did in earlier phases of world economic history. He also considers at some length the application of the doctrine of balanced growth, which he expounded in other writings, to the pattern of expansion of output for domestic markets.]

TRIFFIN (R.). The Future of the European Payments System. Wicksell Lectures 1958. Stockholm: Almqvist & Wiksell, 1958. 9½". Pp. 43. Sw.kr. 3.50.

[These are the first of a new series of annual lectures in Stockholm by visiting economists that has been instituted in commemoration of the name of Wicksell. In the first of his two lectures Professor Triffin considers the nature and historical background of the European payments problem in

general terms. He argues that in the nature of things no simple mechanism of international payments will serve, and he suggests that, partly because of the practical administrative consequences of this complexity, there is scope and need for regional groupings and organisations as well as world-wide bodies like the I.M.F. In his second lecture Professor Triffin puts forward certain more concrete proposals for a European clearing union.]

Norwegian

THONSTAD (T.). Produksjonsstruktur, Import og Sysselsetting: En krysløpsstudie. (Structure of Production, Imports and Employment: An Input–Output Study.) Samfunnsøkonomiske Studier No. 8. Oslo: Statistisk Sentralbyra, 1959. 9¼". Pp. 129.

[This monograph has a short English summary, and English translations are also given of the main table-headings. It is concerned with the application of input–output analysis to various problems about the relation between the level and structure of demand in Norway, on the one hand, and her demand for imports, on the other. Some of these problems have a considerable general interest, and the input–output technique is applied in a number of different ways in the endeavour to solve them. Much use is made of a rough division of imports into two classes, those that are and are not in competition with domestic sources of supply.]

Egyptian

NATIONAL BANK OF EGYPT. Credit and Banking Developments in 1958. Cairo: National Bank of Egypt, 1959. 9¼". Pp. 78.

[This is the first report of a new department set up within the National Bank of Egypt, the Control of Banks Department. The report consists of two parts. The first part describes in general terms the means by which control of banks is exercised in Egypt, and the second part deals with the problems involved in the preparation of statistics of bank credit.]

Official

SOUTH AFRICAN

MCWHIRTER (D. J. L.). Industry in Greater Durban: Part II: Raw Materials as a Factor in Industrial Location. A study by the Department of Economics, University of Natal. Pietermaritzburg: Town and Regional Planning Commission, Natal, 1959. 10". Pp. x + 100.

[This consists largely of a descriptive survey of industries operating in Greater Durban. The final chapter considers in more general terms the factors responsible for Durban's strength as an industrial centre. Much the most important of these is its position as the largest port serving the hinterland where the bulk of the Union's purchasing power is concentrated.]

AMERICAN

NATIONAL SCIENCE FOUNDATION. Bibliography on the Economic and Social Implications of Scientific Research and Development. Washington, D.C.: U.S. Government Printing Office, 1959. 9". Pp. 53. 25c.

[This is a classified and annotated bibliography of recent publications falling within the field specified. This field is interpreted in a broad sense, and a number of the items included are concerned with quite general problems of economic development.]

NATIONAL SCIENCE FOUNDATION. Current Projects on Economic and Other Impacts of Scientific Research and Development, 1959. Washington, D.C.: U.S. Government Printing Office, 1959. 9". Pp. 59. 25c.

[This contains a classified list of research projects currently under way relevant to the economic impact of scientific research and progress. Each item is accompanied by a brief description of the aims and methods of the project concerned.]

JAPANESE

ECONOMIC RESEARCH INSTITUTE, ECONOMIC PLANNING AGENCY. Employment Structure and Business Fluctuations. Economic Bulletin No. 2. Tokyo: Economic Research Institute, Economic Planning Agency, Government of Japan (Kasumigaseki, Chiyada-ku), 1959. 11¼". Pp. 108.

[This is a most interesting essay, in which a large array of statistical evidence is analysed in order to explain why fluctuations in effective demand in Japan appear to have so little effect on either unemployment or employment. The explanation put forward has two main elements. In

the first place, contractions in demand, such as that of 1958, have been largely confined to investment, and output of consumer goods has continued to rise. Since the consumer goods industries contain a larger proportion of small firms with low productivity, this has meant that employment has fallen less than output. In the second place, in prosperous times the small firms draw a sizeable proportion of their labour force from women and others who are not the chief wage-earners in the family, and these withdraw from the labour force in recessions. Adult male workers can always find some sort of job, but in depressed times they are obliged to accept the less well-paid jobs that would otherwise be carried out by subsidiary members of the labour force. In developing their argument, the authors provide much interesting detail about the peculiarities of the Japanese about labour market and about their historical origins and effects. Prominent among these is the unusually wide spread in wage-rates. Wages depend largely on seniority within the firm, and large firms offer more stable employment than small ones; hence average wages are much higher in large firms. Not all of the many points made by the authors seem to have been quite fully worked out to their conclusions, and the section devoted to formal theoretical analysis is somewhat disappointing; but this is none the less a suggestive and valuable piece of work.]

INTERNATIONAL

INTERNATIONAL LABOUR OFFICE. The International Standardisation of Labour Statistics. Geneva: I.L.O., 1959. 9½". Pp. vi + 124. 6*s*.

[This follows up earlier reports on the same subject that have been prepared at intervals by the International Labour Office. The first part consists of a description of the work done at the international level in the standardisation of labour statistics. The second part reproduces the basic documents containing international standards in the field of labour statistics.]

ORGANISATION FOR EUROPEAN ECONOMIC CO-OPERATION. The Elimination of Double Taxation. Second report by the Fiscal Committee of the O.E.E.C. Paris: O.E.E.C., 1959. 9½". Pp. 51. 5*s*.

[This report describes the progress so far made towards the implementation of the recommendation made by the Council of the O.E.E.C. regarding double taxation on October 11, 1958. It also contains a new set of proposed articles suitable for insertion in bilateral conventions on double taxation.]

A Public Development Program for Thailand. Report of a mission organized by the International Bank for Reconstruction and Development at the request of the Government of Thailand. Baltimore, Maryland: The Johns Hopkins Press for the International Bank for Reconstruction and Development (London: Oxford University Press), 1959. 9". Pp. xvi + 301. 48*s*.

[The economic position of Thailand since the War has been, as is well known, more fortunate than that of most countries in Asia, largely because of the favourable ratio of resources to population. There are, however, signs that the causes that have been mainly responsible for growth up to now in income per head are losing some of their force. Most of the best rice land has been occupied and the most accessible teak forests have been cut, while population continues to increase at more than 2% per year. The report maintains that there is none the less still great scope for expansion in primary production. In particular, Thailand's potential as a rubber producer is very considerable if the right inducements to producers can be made available. The report argues in favour of a major change in the cropping pattern in the north-east, which is at present the poorest part of the country. The mission was not on the whole impressed by the Government's success hitherto in formulating coherent aims of economic policy or in carrying them out, and they make many suggestions for improvement, not only in the sphere of primary production, but also in the encouragement of manufacturing, the provision of transport, education, and general administration and finance. The head of the mission was P. T. Ellsworth.]

UNITED NATIONS FOOD AND AGRICULTURE ORGANISATION. Marketing Problems and Improvement Programs. F.A.O. Marketing Guide No. 1 by J. C. ABBOTT. Rome: F.A.O., 1958. 9". Pp. xiii + 260. 12*s*. 6*d*.

UNITED NATIONS FOOD AND AGRICULTURE ORGANISATION. Marketing Fruit and Vegetables. F.A.O. Marketing Guide No. 2. Rome: F.A.O., 1957. 9". Pp. xii + 205. 10*s*.

[The first of these two publications describes the main problems involved in the movement of food and raw materials from the farm to the final consumer. The many practical examples cited are drawn largely from under-developed countries. The final chapter deals with possibilities of improvement. These are subdivided according as they may be carried out by private enterprise, by co-operatives, by marketing boards, by governments or by the F.A.O. itself. The second report deals more fully and in more technical terms with the problems involved in the marketing of fruit and vegetables.]

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